Regulation of Water Levels on Lake Manitoba
and along the Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River and Related Issues

A Report to the Manitoba Minister of Conservation

Volume 1
Summary Report
July 2003

The Lake Manitoba Regulation Review Advisory Committee

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Executive Summary

The Lake Manitoba Regulation Review Advisory Committee was appointed in 2001, following complaints to the Minister of Conservation with respect to relatively high water levels on Lake Manitoba.

The Terms of Reference developed to guide the Lake Manitoba Regulation Review Advisory Committee are as follows:

- Determine the most acceptable and practicable range of regulation within which the levels of Lake Manitoba might be controlled;
- Decide if it is practicable and desirable to maintain the lake at certain levels during different seasons of the year, and from year to year, and if so recommend specific levels or range of levels;
- Determine the best course of action for water levels along the Fairford River, Lake Pineimuta, Lake St. Martin and the Dauphin River, including the best course of action with respect to the operation of the Fairford Dam; and,
- Examine existing data with respect to the present water quality of Lake Manitoba and compare to historical water quality.

Attempts have been made to regulate Lake Manitoba water levels for about 100 years. In 1961, following a period of very high lake levels, the present Fairford River Water Control Structure (FRWCS) and associated channel improvements were constructed. Since then, Lake Manitoba has been regulated to a target level of 812.17 feet above sea level (ft asl) with a range from 810.87 to 812.87 ft asl. This is a much narrower variation than the historical range of approximately 810.0 to 816.0 ft asl recorded since water level recording began in 1913.

Managing Lake Manitoba water levels within this narrower range has raised concerns from many groups with an interest in the land, shoreline and marshes bordering the lake. These include cottagers, tourist camp operators, First Nations, commercial fishers, ranchers and those concerned with the health of the marshlands and associated wildlife, and with water quality in Lake Manitoba and areas downstream.

Cottagers are divided on the issue of water levels. Those in the south at Twin Lakes Beach and Delta Beach feel that the target level of 812.17 ft asl is too high and contributes to erosion, particularly during storms. These cottagers would prefer a level of 811.5 ft asl, particularly as fall approaches. Due to their location on the lake, these properties are affected by the highest potential wind setup (wind tide) and wave heights on the lake. This is because they are located at the receiving end of the longest fetch, or distance of open water, on the lake.

South basin cottagers north of Twin Lakes Beach as well as those in the north basin want higher water levels. They prefer a target level of 812.17 ft asl or higher to provide easier access to the lake and deeper water for boating and to prevent the growth of weeds. These cottagers are not as affected by wind setup and erosion as those on the south shore.

The Lake Manitoba fishery is the third largest commercial fishery in the province. The opinion was offered that this fishery has not been affected by regulated water levels. However, commercial fishers are very concerned that the FRWCS inhibits the passage of fish into and from Lake Manitoba. They are also concerned, as are all interest groups, with the operation of the Portage Diversion and its perceived effect on lake levels and water quality.

Ranchers are an important part of the regional economy. They rely on the lands surrounding Lake Manitoba and in the Lake St. Martin area for the production of hay and forage. While recognizing that occasional high water levels are good for hay production, ranchers would prefer lake levels in the 811.5 ft asl range beginning in mid to late June, and through the summer to allow for the harvest of native hay.

Wildlife interests have indicated that maintaining a relatively constant water level on Lake Manitoba has resulted in a significant deterioration of the marshlands surrounding the lake. This has reduced the habitat quality to the point where the marshes do not support the waterfowl populations that gave Delta Marsh and the other coastal marshes their world-class designation. Water quality, plant diversity, fish spawning habitat and landforms within the marshes have all been adversely affected.

Marshlands require a water level management regime that reflects the natural wet and drought cycles of the prairies in order to maintain their biodiversity. While lake levels have fluctuated as much as six feet historically (from approximately 810.0 to 816.0 ft asl), most presenters agreed that a return to that amount of fluctuation would be impractical. They granted that a range of fluctuation in the order of three feet would likely be adequate to restore the health of the marshes over time.

All interested parties are concerned with the issue of water quality on Lake Manitoba and downstream, and in particular how the Portage Diversion may impact water quality. There is also a concern that the current water quality monitoring protocol may not be adequate to properly determine trends in water quality in Lake Manitoba. The present collection and analysis of water quality samples appears inadequate to address many of the questions posed to the Committee about spatial and temporal changes in water quality.

The attempts to maintain Lake Manitoba within the target range and the ability of the FRWCS to convey flows through the Fairford River both greater and lesser than they would be under natural conditions has significantly increased the variability of downstream flows and water levels. The variability in water levels has been transferred downstream to Pineimuta Lake, Lake St. Martin and the Dauphin River, increasing both the frequency and severity of flood and drought periods.

First Nations downstream of the FRWCS are affected most by the variability of water levels. High water levels on Lake St. Martin results in many adverse effects on these communities, including direct flooding of low-lying homes.

In the past, cattle ranching was an important part of the regional economy around Lake St. Martin, and remains so on lands located within the RM of Grahamdale. This was based to a large degree on the harvest of the marsh meadows for the production of hay and forage. After the loss of several hay crops in the 1960s due to unexpected high flows late in the season, the Province of Manitoba bought all the privately held land around Lake St. Martin. However, the Province was not able to purchase the land occupied by the three First Nations in this area. Residents state that cattle ranching in these communities has been affected by the reduction in native hay to the point where the industry is no longer a significant activity on First Nation's land.

Low water levels make access to Lake St. Martin difficult and results in damage to the fishery. Low flows along the Dauphin River prevent the upstream movement of whitefish and other fish species for their annual spawning run. Low water levels and reductions in water levels during the winter have caused commercial fishing nets to be frozen into the ice and lost.

The unnatural fluctuation in water levels along the Fairford River, Pineimuta Lake and Lake St. Martin has resulted in a marked deterioration in the marshlands and a loss of wildlife inhabiting these areas. In the early years of the operation of the FRWCS, flooding and drought conditions often occurred within a single year. Rapid changes in water levels during critical nesting periods dramatically decreased the success of waterfowl. These water level changes also decreased the number of muskrats along the rivers and in the marshes.

While Lake St. Martin water levels have varied between approximately 794.5 and 802.8 ft asl since the construction of the FRWCS, the First Nations have indicated that a more desirable range of Lake St. Martin levels is between 797.0 to 800.0 ft asl. One First Nation presenter advocated having minimum flows in the Fairford and Dauphin rivers of 1100 cubic feet per second (cfs).

In response to the majority of the interested parties, the objective of the Committee is to have water levels on Lake Manitoba managed so that levels at the high end of the range will be similar to those reached during the period of regulation, and low water levels similar to those reached under natural conditions before regulation. At the same time, the wide fluctuations in flows and water levels which have been transferred to downstream water bodies and have created severe problems for First Nations and downstream wildlife, fisheries and tourist operators will be reduced.

Therefore, the Lake Manitoba Regulation Review Advisory Committee recommends a water level management regime which should permit Lake Manitoba to fluctuate between 810.5 to 812.5 ft asl over a period of years insofar as this may be reasonably possible, with the expectation that as a result of water level variations, the lake will rise to 813.0 ft asl in some years and drop to 810.0 ft asl in others. Modeling conducted for the Committee by Manitoba Conservation (See Appendix D: Minimal Log Change Model) indicates that it should be possible to achieve this objective in most years while at the same time lowering Lake Manitoba water levels in the fall to reduce shoreline erosion concerns.

The water level on Lake St. Martin should be maintained between 797.0 ft to 800.0 ft asl insofar as reasonably possible. The minimum flow on the Fairford River and the Dauphin River should be 800-1000 cfs insofar as this may be reasonably possible. Modeling conducted by Manitoba Conservation indicated that significant improvements can be made to the downstream water levels both in reducing annual variation and reducing the frequency of both flood and drought periods. It is unlikely that flooding can be eliminated by operational means alone, especially due to extra flow volume added to Lake Manitoba through the Portage Diversion. Therefore, consideration should be given to the construction of additional works which would better enable the control of Lake St. Martin water levels between 797.0 ft asl and 800.0 ft asl.

The Committee recommends that the issue of water quality data collection and analysis be closely examined. Appropriate measures should be taken to collect and analyze water quality on all the lakes and rivers included in this study and steps taken to address and identify water quality issues.

The Committee strongly recommends that an on-going Lake Manitoba Advisory Committee be established to advise the Minister with respect to a wide range of issues regarding the management of Lake Manitoba and downstream interests.

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1.0 Introduction

Prior to human intervention, water levels on Lake Manitoba varied considerably over the long term with alternating cycles of high and low water. High water prevented farmers from harvesting hay from the marsh meadows. Low water reduced the suitability for boat traffic and affected the wildlife available for hunting and trapping. In addition, the effects of wind and waves on the shallow lake accentuated these variations in water levels. Attempts to control this natural regime began as early as the 1890s.

Starting in 1899, an additional channel was dredged at the outlet of Lake Manitoba into the Fairford River, the only outlet from the lake, in an effort to reduce maximum lake levels. This action proved ineffectual. In 1933, a control structure was built on the Fairford River to help prevent lake levels from falling too low, but this structure could do nothing to manage high lake levels and associated flooding.

In 1961, in response to a period of record high lake levels and shoreline flooding in the mid-1950s, the present Fairford River Water Control Structure (FRWCS) and associated channel improvements were constructed. This structure has been used to control both high and low water levels on Lake Manitoba. Since that date, the lake has been managed to a target level of 812.17 feet above sea level.

Managing Lake Manitoba within a reduced range of water levels has raised concerns from many groups with an interest in the land, shoreline and marshes bordering the lake. Some interest groups have expressed the view that the target level is appropriate while others have suggested that it be changed.

Regulating Lake Manitoba within a narrow range requires continually adjusting the outflow of the lake at the FRWCS on the Fairford River. These adjustments have had a pronounced negative impact downstream on Pineimuta Lake, Lake St. Martin and the Dauphin River where the variability in flows and water levels has increased significantly as a result of these adjustments.

Maintaining Lake Manitoba at a relatively constant level has resulted in the significant deterioration of the quality of the marshlands surrounding the lake and a corresponding reduction in wildlife.

1.1 The Lake Manitoba Regulation Review Advisory Committee

In 2001, the Manitoba Minister of Conservation appointed the Lake Manitoba Regulation Review Advisory Committee (the Committee) to review the current regulation of water levels on Lake Manitoba and areas downstream. Committee members were selected from a variety of groups having an interest in the management of Lake Manitoba (Table 1.1).

Table 1.1: Lake Manitoba Regulation Review Advisory Committee

David A. Farlinger, Chair	Winnipeg	Professional Engineer, Energy Consultants International
James Knight, Vice-Chair	Portage la Prairie	Reeve, RM of Portage la Prairie
Ed Anderson	Fairford	Pinaymootang First Nation
Eric Blais	Winnipeg	Hydrologist, UMA Engineering
Maurice Blanchard	Portage la Prairie	President, Lake Manitoba Commercial Fishing Association
Terry Eyjolfson	Steep Rock	Chair, Lake Manitoba Fish Enhancement Committee
Bill Finney	Eddystone	Manitoba Cattle Producers Association
Garry Grubert	St. Laurent	Twin Lakes Beach Cottage Association
Dr.Gordon Goldsborough	Winnipeg	Delta Marsh Field Station, University of Manitoba
James Richardson	Winnipeg	Institute of Wetland and Waterfowl Research, Ducks Unlimited
Myrle Traverse	Winnipeg	Lake St. Martin First Nation

1.2 Terms of Reference

Terms of Reference were developed to guide the Committee in its task. They are as follows:

- Determine the most acceptable and practicable range of regulation within which the levels of Lake Manitoba might be controlled;
- Decide if it is practicable and desirable to maintain the lake at certain levels during different seasons of the year, and from year to year, and if so recommend specific levels or range of levels;
- Determine the best course of action for water levels along the Fairford River, Lake Pineimuta, Lake St. Martin, and the Dauphin River, including the best course of action with respect to the operation of the Fairford Dam; and,
- Examine existing data with respect to the present water quality of Lake Manitoba and compare to historical water quality.

1.3 Overview of Committee Activities

The Committee held more than 20 regular meetings at which it reviewed and discussed the concerns and issues placed before it, heard presentations from a variety of agencies and organizations and evaluated the findings of studies and reports prepared on its behalf. The Committee also conducted a number of inspection tours to examine first-hand many of the issues it was expected to address.

During April 2002, the Committee held public meetings at five locations – St. Martin, Lundar, Eddystone, Amaranth and Portage la Prairie. More than 25 presentations were made to the Committee during these public forums. A complete description of the opinions and concerns presented by the public are included in Volume 2: Main Report.

In addition to the presentations made at the public meetings, a number of technical presentations were made to the Committee at its regular meetings. The general content of each presentation is summarized in Volume 2: Main Report in the sections to which they relate.

Recommendations and conclusions in this report have been based on information gathered at the public meetings, from subsequent communications with interested parties, from presentations made to and studies commissioned by the Committee, tours of the affected areas and from the knowledge and valuable input of the Committee members themselves.

Left: Committee tours Delta Beach

Below, left and right: Public meetings

2.0 Lake Manitoba Drainage Basin

2.1 General Description

Lake Manitoba is the 33rd largest freshwater lake in the world with a surface area of about 4,700 square kilometres (km^2). The lake is 225 kilometres (km) long from north to south and has about 915 km of shoreline. It is divided naturally into north and south basins at the Lake Manitoba Narrows, located approximately half way along its length near the community of Eddystone. Lake Manitoba has water depths averaging about five metres with a maximum depth of about seven metres.

The Lake Manitoba watershed is part of the Hudson Bay Drainage Basin and covers about 79,000 km^2 including much of west-central Manitoba and a portion of east-central Saskatchewan. The Lake Manitoba drainage area has also been referred to as the Dauphin River Drainage Basin, a reflection of the fact that the only outlet for Lake Manitoba is through the Fairford River/Dauphin River system into Lake Winnipeg. In effect, all of the water that enters Lake Manitoba must leave through the Fairford River, except for that portion lost to evaporation from the lake. See Figure 2.1: Lake Manitoba Drainage Basin

Lake Manitoba drains through the Fairford River at Pinaymootang (Fairford) First Nation, then through the south end of Pineimuta Lake into Lake St. Martin. Pineimuta Lake is a shallow, 39 km^2 wetland complex situated between Lake Manitoba and Lake St. Martin.

Lake St. Martin has a total surface area of approximately 345 km^2 with about 260 km of shoreline. It is comprised of two shallow basins – the larger having a maximum depth of 4.1 metres, the smaller 1.5 metres. Lake St. Martin drains northeastward through the Dauphin River. The Dauphin River is approximately 50 km long, emptying into Sturgeon Bay on Lake Winnipeg.

Land use in the southern and southwestern portions of the basin below the Manitoba Escarpment – from Duck Mountain south – is primarily agricultural with a combination of intense annual crop production and mixed farming. Nearer to the west shore of Lake Manitoba, the emphasis shifts to livestock production, primarily cow/calf operations. Agricultural land use in the Interlake region focuses on mixed farming with an emphasis on livestock, forage and forage seed production.

Throughout the northern portion of the basin – north and west of Lake Manitoba – the landscape is largely in its natural state, except for some mixed agriculture in the Swan River/Birch River area. Cow/calf production is the primary agricultural activity in isolated areas along the northern sections of Lake Manitoba. Forestry activity in the basin revolves around supplying hardwood timber for an oriented strand board plant located in Minitonas.

Figure 2.1: Lake Manitoba Drainage Basin

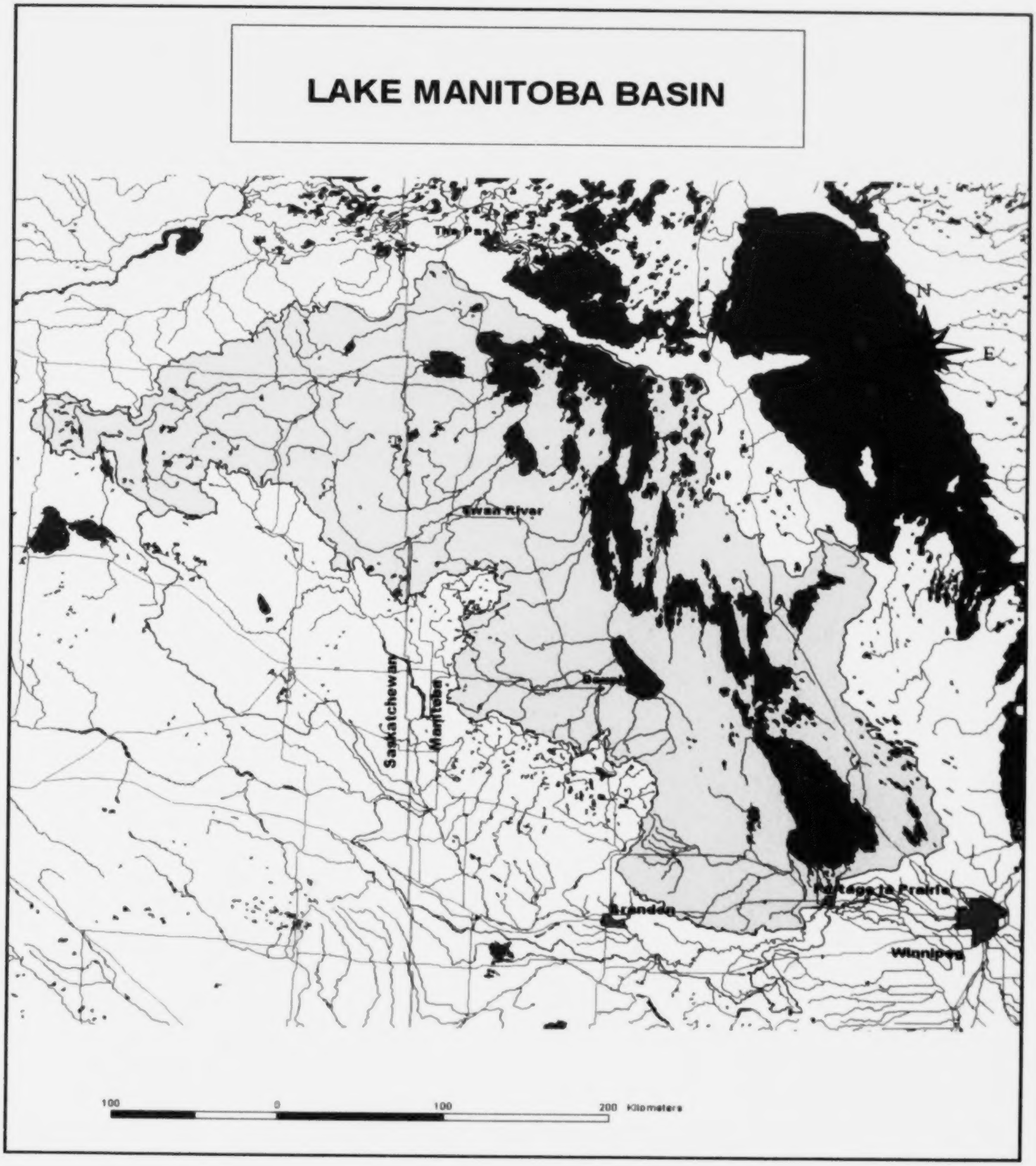
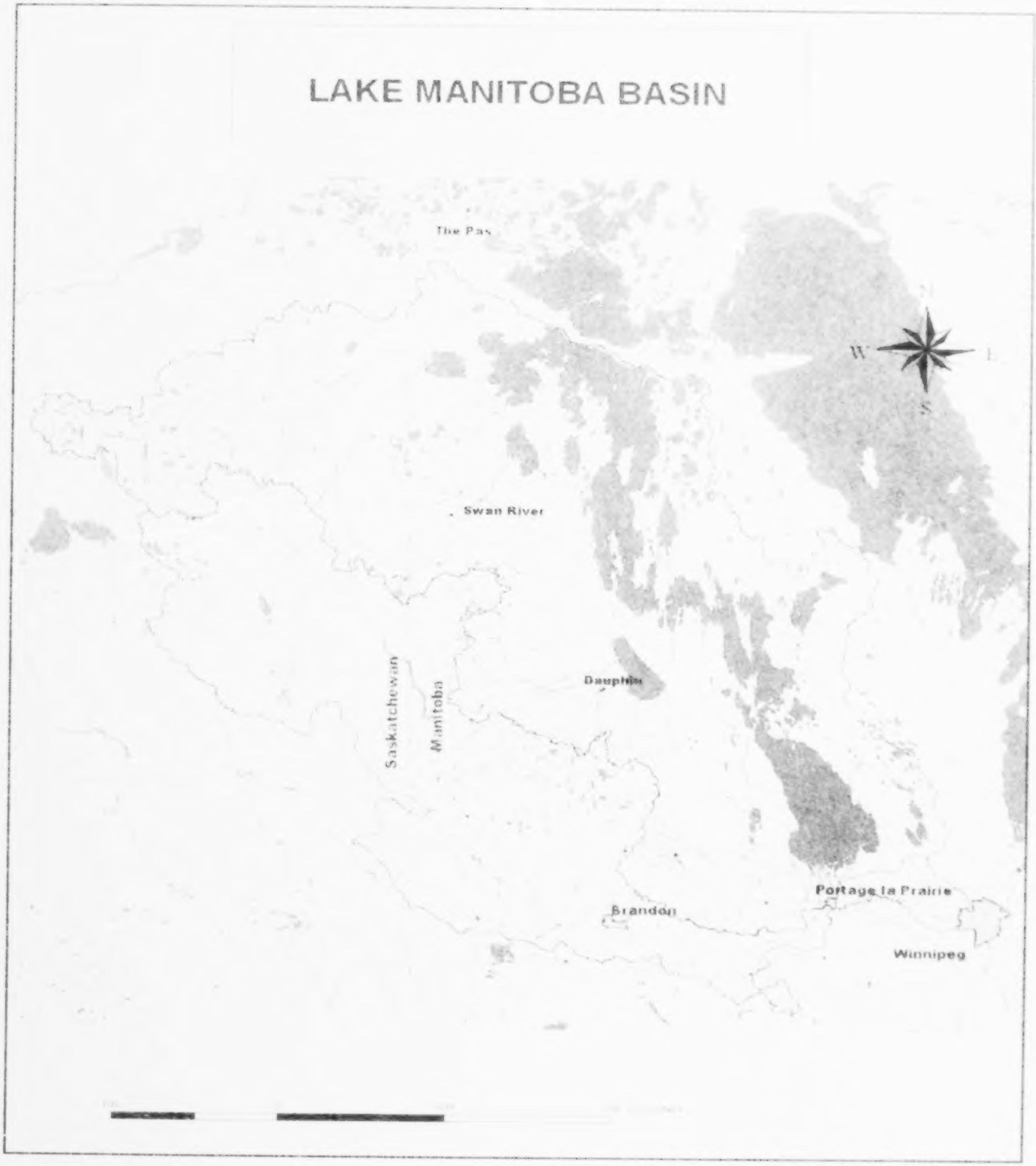

LAKE MANITOBA BASIN
The Pas
Swan River
Dauphin
Saskatchewan
Manitoba
Brandon
Portage la Prairie
Winnipeg
N
E
100
0
100
200 Kilometers

Figure 2.1: Lake Manitoba Drainage Basin


LAKE MANITOBA BASIN
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Manitoba
Dauphin
Portage la Prairie
Brandon
Winnipeg

2.2 Lake Manitoba Regulation

2.2.1 History of Regulation

In the early 1880s, severe flooding around Lake Manitoba lead to a request from local landowners for the federal government to control the lake. This resulted in the excavation of a channel at the outlet of the lake between the years 1899 – 1901. The next major construction adjacent to the Fairford River at the outlet from the lake was instigated to increase water levels following successive dry years in the late 1920s and early 1930s. In 1933, the Province constructed a concrete control dam and timber bridge across the Fairford River immediately downstream of the 1899-1901 channel. This structure remained in place until construction of the current Fairford River Water Control Structure (FRWCS).

The FRWCS was completed in 1961 following a period of excessively high water on Lake Manitoba. The structure was able to control both excessively high and low water levels on Lake Manitoba and was designed to maintain the lake in the range of 810.87 ft asl to 812.87 ft asl (current datum), with a target level of 812.17 ft asl. The operating rules for the structure stated that the lake was to be brought to the target level as quickly as possible.

Below: Fairford River Water Control Structure

In recent years, the Manitoba Water Branch has operated the FRWCS such that the target level is reached over a longer period, resulting in less fluctuation in downstream water levels. The Branch has also been operating to a lower level on Lake Manitoba in the fall to reduce the risk of erosion at the south end of the lake while, at the same time, endeavouring to maintain a minimum flow of 500 cfs in the Fairford River to mitigate negative impacts on the downstream fishery.

Table 2.1: Lake Manitoba Water Levels in feet at Steep Rock.
See also Appendix B: Historic Lake Manitoba water levels

Period	Maxmum water level	Average water level	Minimum water level	Average annual range	Total range for period
Pre-1960	816.25	812.17	809.92	1.40	6.33
1960 - 1999	813.48	811.92	810.36	1.27	3.12
Differences between periods	2.77	0.25	-0.44	0.13	3.21

Table 2.2: Lake St. Martin Water Levels in feet

See also Appendix C, Historic Lake St. Martin water levels

Period	Maximum water level	Average water level	Minimum water level	Average annual range	Total range for period
1960-1998 Observed	802.82	799.01	794.54	3.07	8.28
1960-1998 Calculated Natural	800.29	798.08	795.15	1.65	5.14

Since construction of the FRWCS in 1961, the maximum variation in water levels on Lake Manitoba has been reduced to 3.12 ft between the highest and lowest levels compared to a variation of 6.33 ft prior to 1960 (Table 2.1). Conversely, the variability of Lake St. Martin water levels has increased from a calculated 5.14 ft under natural conditions for the period 1960-98 to a recorded 8.28 ft (Table 2.2).

2.2.2 The Portage Diversion

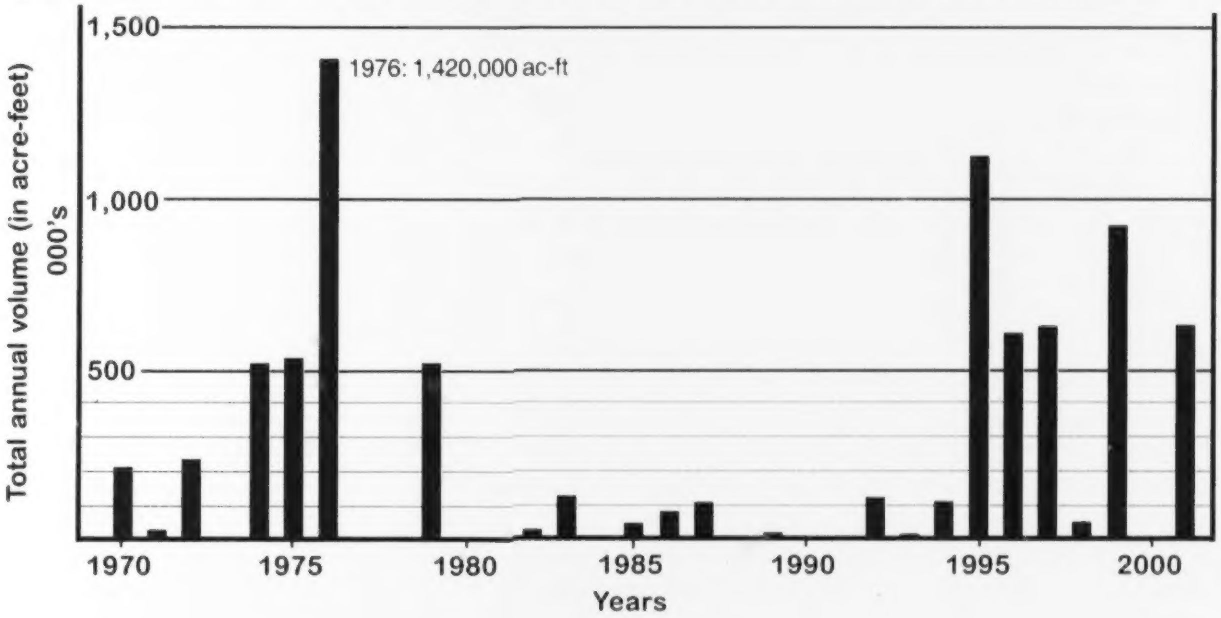
The Portage Diversion is an integral part of the flood control system for the city of Winnipeg. It is designed to convey excess flows on the Assiniboine River into Lake Manitoba near Delta. The Portage Diversion has been used 23 times since its completion in 1970. Concern was expressed at many of the public meetings about the perceived impact of the Diversion on water quality and lake levels.

Below:
Portage Diversion at the Assiniboine River

The largest impact of the Diversion on Lake Manitoba occurred in 1976 when 1,420,000 acre-feet (ac-ft) of flow was diverted into the lake (Figure 2.2, page 8). This volume would correspond to a 1.22 ft increase in the water level on Lake Manitoba if all of the water had been retained in the lake. However, as the lake level rises, the outflow through the FRWCS increases, thereby allowing some of this volume to flow out of the lake. The Water Branch estimates that the net impact of the Diversion in 1976 was to add about 10 inches to the lake level.

The average annual volume of water directed into Lake Manitoba through the Diversion over the 33 years of its existence is 246,774 ac-ft. This amount of water would account for a rise in Lake Manitoba water levels of approximately 2.6 inches. This small increase would have little impact on the outflow through the FRWCS.

Figure 2.2: Portage Diversion - Years of Operation and Volumes



2.3 Summary of Previous Studies

2.3.1 Lakes Winnipeg and Manitoba Board - 1958

Following the high lake levels of the mid 1950s, the Lakes Winnipeg and Manitoba Board was established in 1956 as a joint Federal - Provincial Board. Its assignment was to determine what further developments and controls of the water resources would appear to be physically practicable with particular reference to flood control on Lake Manitoba and hydro-electric power generation.

In its 1958 report, the Board recommended construction of the Fairford River Water Control Structure (FRWCS), which was completed in 1961. The range selected for lake level management was from 811.0 ft asl to 813.0 ft asl with a target level of 812.3 ft asl (all in 1960s datum). Subsequently these levels were reduced by 0.13 ft as a result of a survey datum adjustment.

Under these operating rules, flows through the FRWCS were regularly adjusted to bring the level of Lake Manitoba either up or down to the target level as quickly as possible, maintaining a relatively stable level. However, the variability in water levels was transferred downstream to Pineimuta Lake, Lake St. Martin and the Dauphin River resulting in high water and flood damage in some years and extremely low water levels in other years, often accompanied by wide variations within the year itself.

2.3.2 Manitoba Water Commission, 1973

From the beginning of operation of the FRWCS, complaints and concerns were expressed by residents of the region about the regulation of Lake Manitoba within the 810.87 to 812.87 ft asl range (revised datum).

In December of 1968, the Province asked the Manitoba Water Commission to review and identify the most acceptable and practical range of levels within which to regulate Lake Manitoba. In so doing, the Commission was requested to consider the wish of ranchers around Lake Manitoba to regulate the lake to a level of 811.67 ft asl (revised datum).

In December 1973, the Commission released its report. The major focus was on the impact of the operation of the FRWCS downstream on the agricultural, wildlife and fisheries resources on Pineimuta Lake and Lake St. Martin and environs. The study concluded that lowering the target level on Lake Manitoba would reduce the social and economic values of the recreational, wildlife and fisheries resources on and around Lake Manitoba and that the only resource use to benefit from lower lake levels would be agriculture where additional native hay land would be made available.

The Commission recommended that Lake Manitoba continue to be regulated to target elevation 812.17 ft asl with the same range of 810.87 to 812.87 ft asl.

2.3.3 Manitoba Water Commission, 1978

Concerns about the wide fluctuations of water levels on Pineimuta Lake and Lake St. Martin continued and numerous complaints were directed to the Province. In 1977, the Province instructed the Manitoba Water Commission to examine alternatives for managing water levels and solving the related problems downstream of the FRWCS.

A variety of structural water management schemes were examined. While all of the options considered would have had a beneficial effect on water levels in Pineimuta Lake and Lake St. Martin, it was determined that the costs of implementing any of these schemes would out-weigh the benefits accrued.

As a result, the Commission in its 1978 report recommended that no structures should be built downstream from the FRWCS, and that the operation of the FRWCS should be re-examined to determine if marginal adjustments could be made to prevent large sudden changes in water levels downstream. The Commission also suggested it would not be unreasonable to consider mitigation of the financial problems of the users in the Lake St. Martin area affected by water level fluctuations.

Although not phrased as a recommendation, the Commission suggested that there should be an evaluation of a plan in which the entire watershed of Lake Winnipegosis, Lake Manitoba, Lake St. Martin and Pineimuta Lake leading into Lake Winnipeg be considered as one economic unit.

3.0 Findings

The Lake Manitoba Regulation Review Advisory Committee is the most recent government-appointed group to examine the regulation of Lake Manitoba and the impact on the land and water courses downstream of the Fairford River Water Control Structure. Through its investigations, consultations and deliberations, the Committee has become aware of a number of facts or findings related to Lake Manitoba and areas downstream.

Detailed discussion substantiating the development of these findings appears in Volume 2: Main Report.

3.1 Lake Manitoba

3.1.1 Water Levels

a) Attempts have been made since the late 1800s to control the level of Lake Manitoba. These attempts have been in response to events such as high lake levels in the early 1880s, low levels in the 1930s and high water levels again in the mid-1950s.

b) The majority of overland flow into Lake Manitoba is from Lake Winnipegosis through the Waterhen River. During the period 1972 to 2001, the average annual contribution of the Waterhen River to Lake Manitoba volumes was 1.9 million acre-feet (ac-ft). The Whitemud River and local overland flows combined, excluding the Portage Diversion, averaged 257,000 ac-ft. Precipitation contributes about 1.8 million ac-ft directly to Lake Manitoba annually.

c) The Portage Diversion has been operated 23 times since its completion in 1970. The largest contribution of water to Lake Manitoba by the Portage Diversion occurred in 1976, when 1,420,000 ac-ft entered the lake through the Diversion. This would have amounted to an increase in the lake level of 1.22 ft, assuming the Fairford River Water Control Structure had not been in operation. However, the net impact has been estimated to be the addition of about 10 inches to the lake level.

Below: Portage Diversion outlet at Lake Manitoba

Over the 33 years since it opened, the Diversion has contributed an average annual volume of 246,774 ac-ft to Lake Manitoba. This amount of water would equate to 2.6 inches in lake water level.

The Province has recently undertaken structural modifications to the Diversion to reduce any negative impacts that might occur as a result of using it as an irrigation supply channel.

d) The Fairford River is the only outlet from Lake Manitoba. The average annual discharge through the Fairford River (1972 to 2001) was about 2.0 million ac-ft. Water also leaves Lake Manitoba through evaporation, also averaging about 2.0 million ac-ft per year.

Above:
Fairford River Water Control Structure

e) The Fairford River Water Control Structure, completed in 1961, was designed to regulate both high and low water levels on Lake Manitoba. Since that date, the lake has been regulated to a target level of 812.17 feet above sea level (ft asl), the long-term average level of the lake with a target range of 810.87 ft asl to 812.87 ft asl.

f) Lake Manitoba level records prior to 1961 may not precisely reflect natural conditions since lake level management efforts began with channel improvements to the Fairford River during the period 1899 to 1901, and the completion of a concrete control structure in December 1933.

g) According to water level records (record-keeping began in 1913), the long-term variability of water levels on Lake Manitoba has decreased since construction of the Fairford River Water Control Structure, while water level variations within the year have increased slightly. The long-term variability since regulation is 3.12 ft as compared to 6.33 ft prior to regulation.

h) Modeling carried out by the Water Branch of Manitoba Conservation (Appendix D: Minimal Log Change Model) indicates that, with relatively minor changes in the operation of the Fairford River Water Control Structure, the lake can be maintained for the most part, within a range of 810.5 to 812.5 ft asl, with the expectation levels will rise to 813.0 and drop to 810.0 ft asl in some years. Downstream problems with respect to low water levels as well as flooding should be mitigated at the same time.

3.1.2 Cottage Owners

a) Erosion damage in 1999 at Twin Lakes Beach has been estimated, by lakeshore property owners in the area, at approximately $1,000,000 to cottages, shoreline protection structures, outbuildings and other structures. While this figure has not been independently verified, it is recognized that substantial windstorm-related erosion damage has occurred to shoreline properties generally, and particularly in the southeast portion of the south basin.

b) Lake Manitoba cottagers are divided in their opinions as to the ideal lake level. Those located in southern-most portion of the south basin – Twin Lakes Beach and Delta Beach – want lower levels, ideally 811.5 ft asl, to reduce property damage from erosion and to provide wider beaches. Cottagers and other recreational interests located in the south basin, north of Twin Lakes Beach, as well as those located in the north basin prefer higher water levels (812.0 ft asl or higher) to provide better access for watercraft and to reduce weed growth.

Above: Erosion damage to Lake Manitoba cottages.

3.1.3 Shoreline Dynamics

a) The shorelines along the south basin of Lake Manitoba are primarily granular in composition. On granular shorelines, the shoreline can migrate both onshore and offshore in response to a change in water level or wave conditions. Any erosion or accretion is recoverable.

b) Conversely, cohesive shorelines – those made up of non-granular material such as clay or glacial till – do not accrete, they only erode. Cohesive shorelines may be characterized by low to steep bluffs along the beach. If the water level increases on a cohesive shoreline, erosion will occur by down-cutting of the foreshore or by undercutting shoreline bluffs. There will be a general, irreversible loss of the beach.

3.1.4 Fisheries

a) While the success of the commercial fishery in Lake Manitoba is not necessarily directly related to water levels, high water can strand fry in pools in streams flowing into the lake when lake water levels drop in late spring.

b) The predominate marketable fish species caught by commercial fishers on Lake Manitoba has changed from whitefish in the late 1800s to pickerel, sauger and perch today. The reason for this change is unclear to the Committee. There has been a large increase in rough fish such as mullet and carp present in the catch. Tulibee catch remains high, although it is not considered a commercial species at this time.

c) The total recorded catch of the commercial winter fishery on Lake Manitoba has decreased from more than six to eight million kilograms per year in the late 1940s to less than two million kilograms in 2002. There are widely varying opinions between commercial fishers and Manitoba Conservation's Fisheries Branch regarding the cause of this decline. The Committee is not in a position to determine the reasons for the decline.

Above: Fairford River Water Control Structure fish ladder, attraction flume.

d) Commercial fishers on Lake Manitoba blame the Fairford River Water Control Structure for negatively affecting the passage of fish and thus, the fishery on Lake Manitoba.

e) The Committee is not aware of an environmental impact study being conducted prior to the construction of the Fairford River Water Control Structure in 1961. It should be noted that such an assessment was not a requirement of Provincial regulations or legislation of the day.

f) Experts with the Department of Fisheries and Oceans, Freshwater Institute in Winnipeg maintain that the design of the fish ladder at the Fairford River Water Control Structure is a state-of-the-art structure. This does not necessarily mean that the same number of fish pass through the structure to Lake Manitoba as did prior to construction of the structure, but simply that the present fish ladder, properly operated and maintained, is the most effective fish passage structure available.

g) To the knowledge of the Committee, there are no operation and maintenance records for the fish ladder in the FRWCS. There is concern that the fish ladder is not being operated and maintained according to its original design.

3.1.5 Ranching

a) Ranchers generally prefer lower lake water levels, at or near the current target level of 812.17 ft asl in the spring, dropping to a level of 811.0 to 811.5 by late June to allow access to native haylands along the lakeshore. At the same time, ranchers acknowledge that periodic flooding is good for the land and the native grasses in the marshes surrounding the lake.

Above: Many cattle producers rely on marshland hay.

3.1.6 Wetlands

a) There are an estimated 236,700 hectares of marshland in the area surrounding Lake Manitoba, Lake St. Martin and Pineimuta Lake. Historically, these wetlands have been valuable to waterfowl as breeding, moulting and migration staging areas, for furbearers such as mink and muskrat and as spawning and nursery areas for fish. In addition, marshlands provide important habitat for songbirds, shorebirds and colonial water birds.

Above: East Meadows Ranch - an example of a Lake Manitoba coastal marshland

b) The productivity and biodiversity of the coastal marshlands bordering, and connected to Lake Manitoba (including Delta Marsh, officially designated as a "Wetland of International Significance" and a "Heritage Marsh") have deteriorated significantly since lake level regulation began in 1961.

c) Delta Marsh has undergone several marked changes since the 1960s. These include decreases in the area of shallow open water, increases in the amount of suspended sediment, decreases in submerged plants, disappearance of emergent plants that dampen the erosional force of wind and waves, proliferation of hybrid cattail and dramatic declines in waterfowl and muskrat populations. These changes are thought to have arisen due to the smaller range of water levels in the marsh due to regulation of Lake Manitoba, and invasion of the marsh by common carp, an introduced fish species.

d) There is consensus among interests concerned with these marshes that larger variations in water levels over the long term than those experienced since lake level regulation began, are required for the health of the marshes and associated wildlife. Water level fluctuations should be nearer to those that occurred under natural conditions prior to regulation – generally a three-foot fluctuation over time, while considerably less than natural, was considered acceptable.

3.1.7 Water Quality

a) Water quality in Lake Manitoba generally falls within the "fair" to "good" regulatory classes, although values for such parameters as total phosphorus and conductivity often exceed values desirable for drinking water, irrigation, or protection of aquatic life.

b) There is wide-spread concern over the operation of the Portage Diversion and its impact on water levels and water quality of Lake Manitoba. However, many of these concerns appear to be based on perceptions rather than factual evidence.

c) There is also concern with respect to the debris that enters the lake through the Diversion and gathers on Delta Beach, as well as the maintenance of the Diversion itself. Many presenters requested that the use of the Diversion be limited to as short a time period as possible.

d) Provincial government calculations indicate that during the years in which it is operated, the Portage Diversion can comprise over half the total phosphorus inputs to Lake Manitoba. While this may threaten lake water quality, the basis of these calculations is not clear and more data analysis may be required. Consequently, the Committee cannot, at this time, fully evaluate the importance of the Portage Diversion as a source of nutrients, sediments, pesticides, debris, and other materials to Lake Manitoba.

e) Water quality in Lake Manitoba has been studied since at least 1928 but more intensively since the 1960s, and especially since 1991. Samples have been collected from over 20 sites in Lake Manitoba, some in the north basin but most in the south basin. The current monitoring program consists of monthly measurements at a single site in the south basin of Lake Manitoba, monthly sampling of the Assiniboine River upstream of the Portage Diversion, and monthly sampling of the Whitemud and Waterhen Rivers.

f) The Committee has not been able to ascertain if the present provincial government water quality monitoring infrastructure on Lake Manitoba is adequate for determining lake-wide trends in water quality.

g) Evaluation of inter-decadal water quality trends is difficult due to improvements over time in methods of measurement, collection of water samples at different sites around the lake at different times, and different lengths of time during which measurements were taken. Therefore, the Committee believes the only data on which it is valid to examine trends over time are those collected year-round at monthly intervals since 1991.

Below: An example of organic debris gathered on Lundar Beach

3.2 Downstream of the Fairford River Water Control Structure

3.2.1 Water Levels

a) The Fairford River Water Control Structure (FRWCS), operated since 1961, has the ability to permit both higher and lower outflows from Lake Manitoba than under natural conditions. The operation of this structure has drastically increased the variation in flows and water levels downstream.

b) Modeling conducted by UMA Engineering for Indian and Northern Affairs Canada has demonstrated that compared to natural conditions:

- Fairford River peak flows have approximately doubled.
- On both Pineimuta Lake and Lake St. Martin, maximum lake levels have increased significantly since the construction of the FRWCS.
- Water levels below 797.0 ft asl occur on Lake St. Martin about twice as often as they would under natural conditions.
- With the present operation of the FRWCS, water levels on Lake St. Martin can be expected to exceed 800.0 ft asl significantly more often than under natural conditions.

Details are presented in Volume 2: Main Report.

c) Since 1960, there have been numerous annual peak water levels on Lake St. Martin that exceeded elevation 800.0 ft asl, the approximate level when flooding occurs. Many of these events exceeded this level by more than one foot and a few by approximately three feet. Under calculated natural conditions, only a few events would have exceeded 800.0 ft asl.

d) The increased variability in water levels is even greater on Pineimuta Lake than on Lake St. Martin. This has had an adverse on wildlife habitat.

e) There is no artificial control on the flow of water from Lake St. Martin into the Dauphin River and large variations of outflow from Lake Manitoba also affects the Dauphin River.

3.2.2 Communities

a) First Nations on the Fairford, Little Saskatchewan and Narrows Reserves, downstream of the FRWCS are affected most with the variability of water levels. As the privately held land affected by flooding was purchased by Manitoba in the 1960s, the First Nations are the only rights holders with shoreline land. High water levels adversely affect many activities in these communities including direct flooding of low-lying homes.

Below:
Lake St. Martin

b) Indian and Northern Affairs Canada indicates that the Federal government has incurred costs of approximately $20 million over the past ten years for short-term flood control and associated activities. This investment has been ineffective in providing a long-term solution to the flooding problem around Lake St. Martin.

c) Widely fluctuating flows through the FRWCS and associated changes in water levels on Lake St. Martin and Pineimuta Lake have resulted in impacts to economic and traditional activities including ranching, fishing and trapping.

3.2.3 Fisheries

a) Low water levels on Lake St. Martin create problems with the whitefish and walleye fishery, including the loss of fish in the winter due to low oxygen levels, and fish becoming trapped in pools in the Fairford and Dauphin rivers and being lost when the pools freeze to the bottom. Low water levels also create boating access problems for residents of the area during the open water season. Low flows in the Fairford and Dauphin rivers can inhibit the annual spawning run.

b) The fishery on Lake St. Martin requires lake levels of 797.0 ft asl or higher to be successful. According to Manitoba Conservation's Fisheries Branch and local fishers, the ideal level is about 799.0 ft asl. In addition, correspondance from the Director of Fisheries to the Deputy Minister of Natural Resources in 1981 indicated that minimum flows of 1000 cfs are also required on the Fairford River to permit successful spawning, particularly the fall whitefish spawn. Changing water levels on Lake St. Martin during the winter fishing season causes great difficulties for fishers such as nets freezing in the lake.

c) Low winter flows were also a contributing factor in the closing of the Dauphin River Fish Hatchery as low flows and dissolved oxygen resulted in several years when significant numbers of the fry in the hatchery perished.

3.2.4 Ranching

a) In the past, cattle ranching was an important part of the regional economy around Lake St. Martin, and remains so on land located within the RM of Grahamdale. This was based to a large degree on the harvest of the marsh meadows for the production of hay and forage. After the loss of several hay crops in the 1960s due to unexpected high flows late in the season, the provincial government bought all the patent land around the lake. The province was not able to purchase the land occupied by the three First Nations in this area.

**Above:
Marshland hay**

b) Residents state that cattle ranching by the First Nations communities has declined during the regulated period to the point where it is no longer a significant activity.

3.2.5 Wetlands

a) There have been no recent studies of the wetlands surrounding Pineimuta Lake and Lake St. Martin. However, it has been brought to the attention of the Committee that the large increase in annual variation in water levels on these lakes has resulted in significant deterioration in the health of the marshlands and indigenous wildlife.

b) Ducks Unlimited indicated in their submission to the 1978 Manitoba Water Commission that the waterfowl production on Pineimuta Lake had fallen to four per cent of its potential capability and that muskrat populations were also severely affected by the operation of the FRWCS. For example, in the winter of 1975-76, 70 per cent of the muskrat lodges were flooded out in a 30-acre sample area.

c) The problems encountered downstream of the FRWCS are not the same as those in the marshes surrounding Lake Manitoba where stable water levels have affected habitat. On the downstream marshes, wide variations in water levels have reduced the ability of waterfowl and fur-bearing animals to survive and reproduce.

**Below:
Lower Fairford
Bridge**

3.2.6 Water Quality

a) Limited information exists for water quality in the Fairford and Dauphin rivers. No water quality monitoring is currently conducted on Pineimuta Lake and Lake St. Martin.

b) The First Nations blame increased flooding of their lands for problems with potable water quality.

4.0 Recommendations

The Lake Manitoba Regulation Review Advisory Committee respectfully submits the following recommendations to the Manitoba Minister of Conservation.

Lake Levels

1) Lake Manitoba should be managed in a more natural fashion based on the Minimal Log Change Model (Appendix D) developed for the Committee by the Manitoba Water Branch. Utilizing this model, or a refined version, the following operating rules for the Fairford River Water Control Structure (FRWCS) should be applied:

a) Water levels on Lake Manitoba should be permitted to fluctuate between 810.5 and 812.5 feet above sea level (ft asl) over a period of years, insofar as this may be reasonably possible, with the expectation that water levels on the lake may rise to 813.0 ft asl in some years and drop to 810.0 ft asl in others;

b) Any variance in the lake levels outside of the range shall be shared between Lake Manitoba and Lake St. Martin, insofar as this may be reasonably possible;

c) The level of Lake St. Martin should be maintained within a more natural range of 797.0 ft to 800.0 ft asl insofar as this may be reasonably possible, in order to reduce flooding, to provide better access for commercial fishing and recreational interests, to enhance the commercial and sport fisheries, to maintain marshlands in a natural state, to restore the natural aesthetics of the region and to provide for hayland for local ranchers;

d) The minimum flow in the Fairford River should be 800 cubic feet per second (cfs) with a desirable flow of 1,000 cfs insofar as the achievement of both of these flows may be reasonably possible; and,

e) An additional water level monitoring station should be installed on Lake St. Martin nearer the existing communities along the north shore.

FRWCS; Fish Ladder

2) Fairford River Water Control Structure (FRWCS) and Fish Ladder.

a) Operating and maintenance records for the FRWCS and the associated fish ladder should be maintained and made available to the public.

b) Monitoring the condition, and maintenance of, the FRWCS should be conducted on a regular basis.

c) The fish ladder associated with the FRWCS should be operated as per the original design and intent.

d) Maintenance of the FRWCS fish ladder should be carried out on a regular basis.

e) Consideration should be given, in consultation with the Lake Manitoba Commercial Fishing Association, Lake Manitoba Fish Enhancement Committees and Manitoba Conservation Fisheries officials, to the construction of additional fish ladders at such time as the FRWCS is reconstructed, or as deemed appropriate.

Public Initiatives

3) Public Initiatives

a) The Province should work with cottage owners, tourist operators, rural municipalities and First Nations to facilitate and enhance access to Lake Manitoba and Lake St. Martin for swimming and boating and to maintain or enhance the quality of the lakeshore for associated activities.

b) An information delivery system such an Internet website should be developed to provide all stakeholders with historic lake level data and current lake level data on a real-time basis. The site could also provide information related to inflows and outflows including those through the FRWCS, water quality, Portage Diversion operation and other relevant information.

c) Man-made obstructions in outlets connecting marshlands to Lake Manitoba should be removed, where deemed advisable by wildlife experts, to permit the natural flushing action provided by the flow of water between the coastal marshes and their adjoining lakes.

Studies

4) In conjunction with the appropriate partners, the Province of Manitoba should carry out, or cause to be carried out, the studies itemized below. In so doing, due consideration should be given to the insight, Traditional Ecological Knowledge and oral evidence provided by First Nations people and others in regards to the history and management of the lands and resources in the area.

a) Initiate, in concert with the appropriate First Nations, studies to examine means to regulate the outflow of Lake St. Martin and/or Pineimuta Lake into the Dauphin River. The purpose of these studies would be to determine methods of mitigating extreme high and low water levels. Such studies should fully take into account all issues deemed relevant, including the environment, wildlife, fisheries, haylands, downstream and community impacts and social and economic issues.

b) A multi-year scientific study should be carried out to ascertain whether the proposed water level management regime for Lake Manitoba, Fairford River, and Lake St. Martin is successful at reversing the degradation of the lakeshores, coastal marshlands and beaches.

c) Studies should be carried out, in conjunction with the Lake Manitoba Fish Enhancement Committees, to better determine the ability of the current FRWCS fish ladder to pass fish, and to determine methods in which its effectiveness may be improved.

d) An investigation should be conducted into potential methods of reducing the amount of debris being produced and carried in the Portage Diversion channel into Lake Manitoba, and to determine more efficient methods of cleanup along the shore.

e) More thorough analysis of existing water quality data, focusing on trends from 1991 to present, should be carried out. All available sources of data, including remote sensing information from aerial photography and satellite imagery, should be used in this assessment.

f) Thorough mass balance calculations should be conducted to ascertain the relative contributions of the three major channels (Whitemud River, Waterhen River and Portage Diversion) on Lake Manitoba water quality. This may require more data than are presently available. If so, collection of such data should be a priority of a short-term, intensive monitoring program.

g) A critical evaluation of the present water quality monitoring infrastructure on Lake Manitoba and connected waterways should be conducted, with the objectives of determining: how many sites are needed to adequately assess lake-wide differences in water quality; how frequently samples should be collected; whether samples collected in the Assiniboine River are representative of water quality conditions in the Portage Diversion during periods of high flow; and whether Lake Manitoba water quality measurements adequately represent those in downstream areas, including the Fairford and Dauphin Rivers, and Pineimuta Lake and Lake St. Martin. This evaluation should involve an intensive water quality monitoring study, with samples collected at numerous sites at regular intervals over a period of at least two years.

5) Portage Diversion

Portage Diversion

a) The use of the Portage Diversion should be restricted to those periods of time and flows which are absolutely necessary to protect downstream interests along the Assiniboine River and in Winnipeg. The operating rules of the Portage Diversion should be re-examined, with the objective of asserting its primary function as a short-term flood protection work, and to minimizing its discharge of nutrients, sediments, debris, and other materials into Lake Manitoba.

b) Clean-up of debris deposited from the Portage Diversion onto Delta Beach and other affected areas each spring the Diversion is operated should be carried out in a timely fashion.

Lake Manitoba Advisory Committee

6) The Lake Manitoba Regulation Review Advisory Committee is of the opinion that the best decisions are reached when all those impacted are involved in the consensus-building process. In that regard, the Committee recommends the establishment of an on-going Lake Manitoba Advisory Committee with representation from all interest groups associated with the Lake Manitoba basin, as well as interests downstream of the Fairford River Water Control Structure. This Committee should be financially supported by the Province of Manitoba and include representation from agriculture, fisheries, First Nations, cottage owners from both basins, other recreation interests, wildlife proponents and other rights holders as the Province deems appropriate.

The Committee's terms of reference should include, but not necessarily be limited to the following:

a) To establish and maintain an on-going dialogue with local interests, municipalities and the Province regarding the management of Lake Manitoba, Pineimuta Lake, Lake St. Martin and the Fairford and Dauphin rivers, to solicit, as required, public input related to these concerns, and to communicate with the public on a regular basis;

b) Communicate with the Minister on an on-going basis with regard to water levels on Lake Manitoba, Pineimuta Lake and Lake St. Martin, including the operation and maintenance of the Fairford River Water Control Structure and the associated fish ladder, and to recommend appropriate seasonal flows to be maintained in the Fairford and Dauphin rivers insofar as this is reasonably possible;

c) Advocate long-term monitoring and research on water levels and the health of Lake Manitoba, Pineimuta Lake and Lake St. Martin, including coastal marshlands along these water bodies, to be carried out by the appropriate agencies and report on the results annually to the Minister. This should include all aspects of water quality, fisheries, wildlife, agriculture, recreation, shoreline erosion, marshland rejuvenation, impacts on First Nations and other communities, and such other matters as deemed advisable by the Committee or by the Minister;

d) Investigate, and if considered advisable, recommend remedial projects to enhance all aspects of the general health of the lakes, associated marshlands and associated resources and resource uses, as outlined in section (c) above. In this regard, the Committee shall actively encourage jointly funded private sector/government projects;

e) To appoint a member of the Lake Manitoba Advisory Committee to the Portage Diversion Advisory Committee to ensure that Lake Manitoba interests are taken into consideration in the operation of the Diversion, and

f) To provide other guidance to the Minister as may be deemed appropriate.

g) To facilitate the work of the proposed Lake Manitoba Advisory Committee, all documents collected and commissioned by the Lake Manitoba Regulation Review Advisory Committee should be collected and maintained on file as a source of information and reference.

h) In order to accomplish the above, the Province and the Lake Manitoba Advisory Committee should work in concert, taking full advantage of the knowledge and expertise developed in the existing Lake Manitoba Regulation Review Advisory Committee.

Appendices

A: Imperial/Metric Conversions
B: Historic Lake Manitoba Water Levels
C: Historic Lake St. Martin Water Levels
D: Minimal Log Change Model

Appendix A: Imperial/Metric Conversions

Distance

1 inch (in.)= 2.54 centimetres (cm)   1 cm = 0.39 in.

1 foot (ft) = 0.3048 metre (m)   1 m = 3.2808 ft

1 mile (mi.) = 1.62 kilometre (km)   1 km = 0.621 mi.

Area

1 acre (ac) = 0.405 hectare (ha)   1 ha = 2.471 ac

1 square mile (mi.^{2}) = 2.59 square kilometre km^2 1 km^2 = 0.386 mi.^{2}

Volume

1 acre-foot (ac-ft) = 1.2335 cubic decametres (dam^3)   1 dam^3 = 0.8107 ac-ft

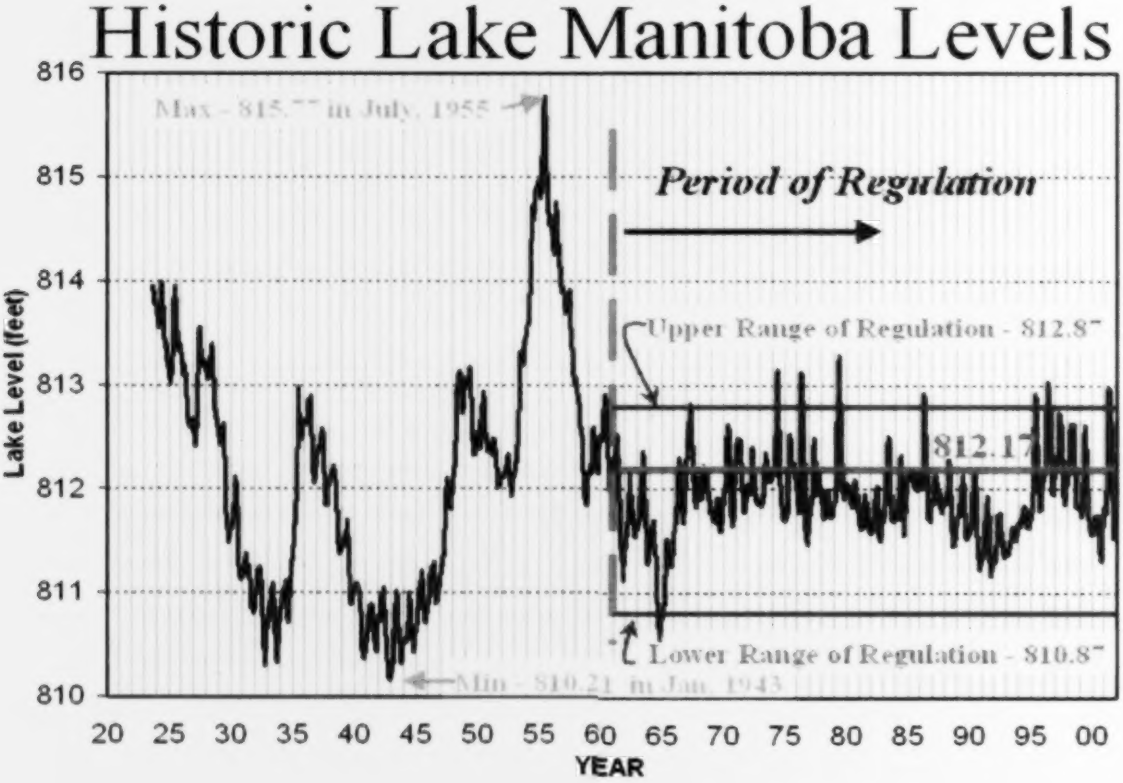
Flow Rate

1 cubic foot per second (cfs) = .0283 cubic metres per second (m^3/s)

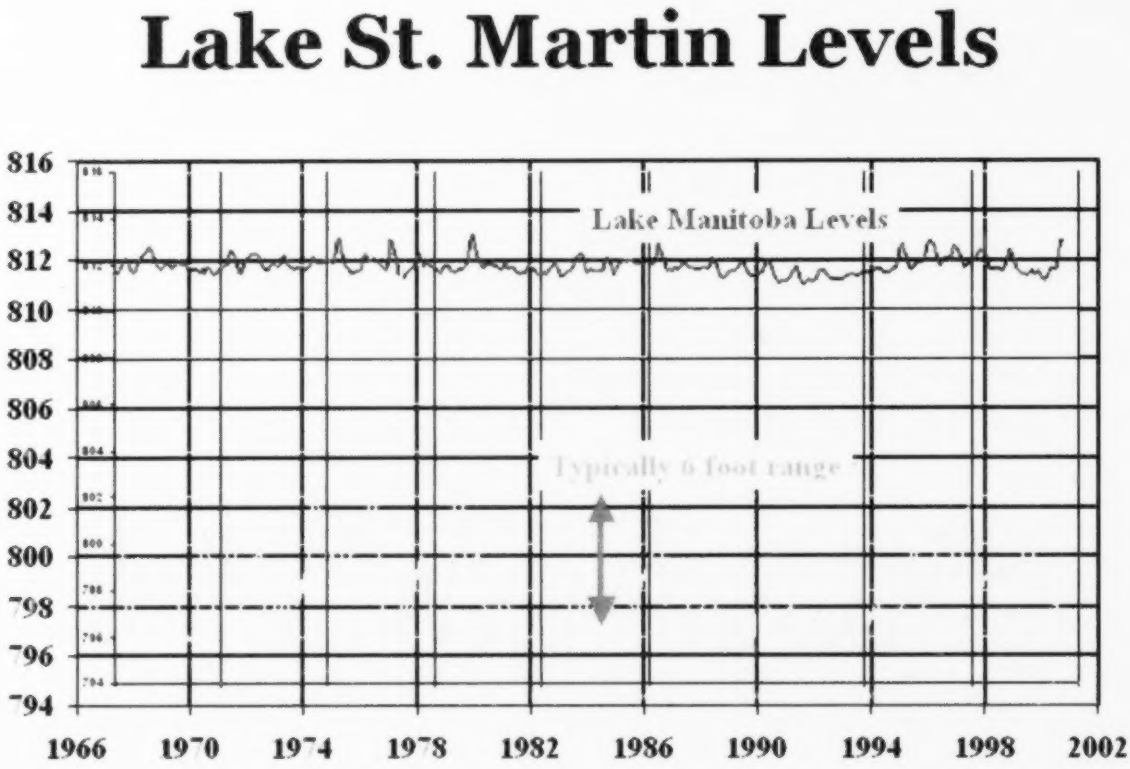
1 m^3/s = 35.315 cfs

Appendix B: Historic Lake Manitoba Water Levels

(Steeprock)



Appendix C: Historic Lake St. Martin Water Levels


Lake St. Martin Levels

Appendix D: Minimal Log Change Model

Manitoba Conservation's Water Branch conducted a series of water level modeling simulations on behalf of the Lake Manitoba Regulation Review Advisory Committee. Graphs displaying the results of the Minimal Log Change Model for Lake Manitoba and Lake St. Martin are presented on the following pages.

Under the Minimal Log Change regime, there are no target levels for water levels on Lake Manitoba and Lake St. Martin. Rather, water levels are generally maintained between 810.5 to 812.5 feet above sea level (ft asl) on Lake Manitoba with the expectation that water levels will occasionally reach 810.0 ft asl or lower on the low side, and 813.0 ft asl or higher on the high side. Water levels on Lake St. Martin will generally be managed between 797.0 and 800.0 ft asl. When both lake levels are within the specified ranges, flow through the Fairford River Water Control Structure (FRWCS) would be maintained at 50 per cent of capacity.

If Lake Manitoba is below its range (below 810.5 ft asl) or if Lake St. Martin is above its range (above 800 ft asl), flows through the FRWCS would be set to the specified minimum. If Lake Manitoba is above its range (above 812.5 ft asl) or if Lake St. Martin is below its range (below 797.0 ft asl) flows through the FRWCS would be increased based on the current procedure.

The minimum outflow through the FRWCS is 800 cubic feet per second, except when Lake Manitoba water levels are too low to produce that amount of outflow.

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Regulation of Water Levels on Lake Manitoba and along the Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River and Related Issues

A Report to the Manitoba Minister of Conservation

Volume 2: Main Report
July 2003

The Lake Manitoba Regulation Review Advisory Committee

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Cover Photo:
Looking west along the Fairford River from the Fairford River Water Control Structure.

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1.0 Introduction

1.1 Background

Prior to human intervention, water levels on Lake Manitoba varied considerably over the long term resulting in alternating cycles of high and low water. Water levels higher than the long-term average prevented farmers from harvesting hay from the marsh meadows bordering the lake. Low water levels reduced the suitability of the lake for boat traffic and affected the wildlife available for hunting and trapping. In addition, the effects of wind on the shallow lake further accentuated these variations in water levels. Attempts to control this natural regime began as early as the 1890s, usually in response to periods of high or low water.

Between 1899 and 1901, an additional channel was dredged at the origin of the Fairford River, the only outlet from the lake, in an effort to reduce maximum lake levels. This action proved ineffectual. In 1933, a control structure was built on the Fairford River to help prevent the lake levels from falling too low, but this structure could do nothing to manage high lake levels and associated flooding.

In 1958, the Lakes Winnipeg and Manitoba Board completed its report on a major study into methods of controlling levels on the lake. This study was largely in response to a period of record high lake levels and shoreline flooding in the mid-1950s, but also with interest in a long-term plan for hydro-electric power generation. As a result, the present Fairford River Water Control Structure and associated channel improvements were constructed in the Fairford River in 1961. Since then, levels on Lake Manitoba have been managed to a target level of 812.17[1] feet above sea level.

Managing Lake Manitoba with a reduced range of water levels for an extended period has raised concerns from many groups with interest in the land, shoreline and marshes bordering the lake. Many of these stakeholders have expressed the view that the chosen target elevation is not appropriate while others suggest it should not be changed. Attempting to maintain Lake Manitoba water levels within a narrow range has required continually adjusting the outflow from Lake Manitoba through the Fairford River. This has had negative impacts downstream on Pineimuta Lake, Lake St. Martin and the Dauphin River where the variability in water levels and flows has increased significantly since the construction of the Fairford River Water Control Structure.

It became clear that the current method of regulating lake levels on Lake Manitoba needed to be re-visited.

1.2 Establishment of the Lake Manitoba Regulation Review Advisory Committee

In 2001, the Manitoba Minister of Conservation appointed the Lake Manitoba Regulation Review Advisory Committee (the Committee) to review the current regulation of water levels on Lake Manitoba and areas downstream. Committee members were selected from a variety of groups having an interest in the management of Lake Manitoba. These included First Nations, commercial fishers, cattle producers, cottage owners, rural municipalities, professional engineers and wildlife proponents. (See Table 1.1) Mr. James Smithson, P. Eng of Manitoba Conservation's Water Branch served as liaison between the Committee and the Department.

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[1] Editor's note: Throughout this report, all measurements (i.e. elevations, flows, volumes, distances, area) are presented in either Imperial or metric values, depending upon the most familiar usage. An Imperial/metric conversion table is presented as Appendix A to this report.

Table 1.1: Lake Manitoba Regulation Review Advisory Committee membership

David A. Farlinger, Chair	Winnipeg	Professional Engineer, Energy Consultants International
James Knight, Vice-Chair	Portage la Prairie	Reeve, RM of Portage la Prairie
Ed Anderson	Fairford	Pinaymootang First Nation
Eric Blais	Winnipeg	Hydrologist, UMA Engineering
Maurice Blanchard	Portage la Prairie	President, Lake Manitoba Commercial Fishing Association
Terry Eyjolfson	Steep Rock	Chair, Lake Manitoba Fish Enhancement Committee.
Bill Finney	Eddystone	Manitoba Cattle Producers Association
Garry Grubert	St. Laurent	Twin Lakes Beach Cottage Association
Dr. Gordon Goldsborough	Winnipeg	Delta Marsh Field Station, University of Manitoba
James Richardson	Winnipeg	Institute of Wetland and Waterfowl Research, Ducks Unlimited Canada
Myrle Traverse	Winnipeg	Lake St. Martin First Nation

1.3 Terms of Reference

Terms of Reference were developed to guide the Lake Manitoba Regulation Review Advisory Committee in its task. These guidelines were prepared based on the understanding of the issues and the concerns which brought about the establishment of the Committee and include reference to water quality in Lake Manitoba as well as to the management of water levels on Lake Manitoba and downstream. They are as follows:

- Determine the most acceptable and practicable range of regulation within which the levels of Lake Manitoba might be controlled,
- Decide if it is practicable and desirable to maintain the lake at certain levels during different seasons of the year, and from year to year; and if so, recommend specific levels or range of levels,
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1.4 Overview of Committee Activities

Lake Manitoba Regulation Review Advisory Committee activities (Table 1.2) included regular meetings at which it reviewed and discussed the concerns and issues placed before it, heard presentations from a variety of agencies and organizations and evaluated the findings of studies and reports prepared on its behalf. Wherever possible, the Committee met at different locations to allow all committee members to become more familiar with the study area and local issues. It also conducted a number of inspection tours to examine first-hand many of the issues the Committee was expected to address.

groups having an interest in the management of Lake Manitoba. These included First Nations, commercial fishers, cattle producers, cottage owners, rural municipalities, professional engineers and wildlife proponents. (See Table 1.1) Mr. James Smithson, P. Eng of Manitoba Conservation's Water Branch served as liaison between the Committee and the Department.

Table 1.1: Lake Manitoba Regulation Review Advisory Committee membership

David A. Farlinger, Chair	Winnipeg	Professional Engineer, Energy Consultants International
James Knight, Vice-Chair	Portage la Prairie	Reeve, RM of Portage la Prairie
Ed Anderson	Fairford	Pinaymootang First Nation
Eric Blais	Winnipeg	Hydrologist, UMA Engineering
Maurice Blanchard	Portage la Prairie	President, Lake Manitoba Commercial Fishing Association
Terry Eyjolfson	Steep Rock	Chair, Lake Manitoba Fish Enhancement Committee
Bill Finney	Eddystone	Manitoba Cattle Producers Association
Garry Grubert	St. Laurent	Twin Lakes Beach Cottage Association
Dr. Gordon Goldsborough	Winnipeg	Delta Marsh Field Station, University of Manitoba
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In April 2002, the Committee hosted a series of five public meetings during which several formal presentations were made to the Committee. Section 3.0 provides a summary of these presentations.

Table 1.2: Activities - Lake Manitoba Regulation Review Advisory Committee

Date	Activity	Location
October 18, 2001	Committee Meeting	Ashern
November 15, 2001	Committee Meeting	St. Martin
December 7, 2001	Committee Meeting	Delta Marsh Field Station
January 10, 2002	Committee Meeting	Winnipeg*
January 30, 2002	Committee Meeting	Winnipeg
March 5, 2002	Committee Meeting	Portage la Prairie
April 2, 2002	Public Meeting	St. Martin
April 4, 2002	Public Meeting	Lundar
April 9, 2002	Public Meeting	Eddystone
April 15, 2002	Public Meeting	Amaranth
April 17, 2002	Public Meeting	Portage la Prairie
April 30, 2002	Committee Meeting	Winnipeg
May 29, 2002	Committee Tour	Lynchs Point, Delta Beach, Twin Lakes Beach, Laurentia Beach, Sugar Point, East Meadows Ranch.
June 30, 2002	Committee Meeting	Winnipeg
July 8, 2002	Committee Meeting	Winnipeg
July 30, 2002	Committee Meeting	Winnipeg
August 11/12, 2002	Committee Tour	Lake St. Martin, Dauphin River
September 5, 2002	Committee Tour	Laurentia Beach
September 12, 2002	Committee Meeting	Winnipeg
September 26, 2002	Committee Tour	Eddystone, Manitowapa Cottage Area
October 10, 2002	Committee Meeting	Winnipeg
October 15, 2002	Committee Meeting	Delta Marsh Field Station
October 24, 2002	Committee Meeting	Winnipeg
November 19, 2002	Committee Meeting	Winnipeg
December 18, 2002	Committee Meeting	Winnipeg
January 17, 2003	Committee Meeting	Delta Marsh Field Station
January 31, 2003	Committee Meeting	Winnipeg
March 12, 2003	Committee Meeting	Winnipeg
April 7, 2003	Committee Meeting	Winnipeg
April 29, 2003	Presentation to Minister	Winnipeg
July 7, 2003	Committee Meeting	Winnipeg

* Winnipeg meetings were held at the Committee's office at Unit #1 – 117 Victor Lewis Drive.

In addition to the presentations made to the Committee at the public meetings, a number of presentations were made to the Committee at its regular meetings. These include:

- Steve Topping, Director, Manitoba Conservation Water Branch – Lake Manitoba regulation
- Dr. Gordon Goldsborough, University of Manitoba – Delta Marsh
- Dwight Williamson, Manitoba Conservation Water Quality Section – Lake Manitoba water quality
- Steve Topping, Director, Manitoba Conservation Water Branch – The Portage Diversion
- Walter Lysack, Manitoba Conservation Fisheries Branch – Issues and concerns
- Chris Katapodis, Freshwater Institute – Fairford Fish Ladder

- Chief Emery Stagg, Dauphin River First Nation and Chief Garnet Woodhouse, Pinaymootang First Nation – First Nations issues
- Rick Bowering, Manitoba Conservation Water Branch - Models of Regulation
- Dr. Jay Doering, University of Manitoba – Dynamics of Shoreline Erosion
- Glen Suggett, Manitoba Conservation Wildlife and Ecosystem Protection Branch – Issues and concerns
- Eric Blais, UMA Engineering – Lake St. Martin flood modeling: Results of a study conducted on behalf of Indian and Northern Affairs Canada

The general content of each of these presentations are summarized in the sections of this report to which they relate. Copies of the presentations, where printed copies were provided to the Committee, will be available at the Manitoba Conservation Library.

Recommendations and conclusions in this report have been based on information gathered at the public meetings, from presentations made to, and studies commissioned by the Committee, tours of the affected areas and from the knowledge and valuable input of the Committee members themselves.

2.0 Lake Manitoba Drainage Basin

2.1 General Description

The Lake Manitoba watershed covers 79,000 square kilometres (km^2) which includes much of west-central Manitoba and a portion of east-central Saskatchewan. The Lake Manitoba drainage area has also been referred to as the Dauphin River Drainage Basin, a reflection of the fact that the only outlet for Lake Manitoba is through the Fairford River/Dauphin River system. All of the water that enters Lake Manitoba must leave through the Fairford River, except for that portion lost to evaporation from the lake.

The basin (Figure 2.1: Lake Manitoba Drainage Basin) is bounded on the west by the Manitoba Escarpment, which includes Riding Mountain, Duck Mountain and Porcupine Mountains in Manitoba, and the Pasquia Hills in Saskatchewan. On the east, the basin is bordered in Manitoba's Interlake region by watersheds that drain directly into Lake Winnipeg. The northern boundary of the basin is shared with the Cedar Lake and Pasquia/Summerberry drainage basins. Areas in the south and southwest are drained by the Assiniboine River and its tributaries.

Drainage within the basin is generally from west to east. All major streams in the basin except the Whitemud River and its main tributary Big Grass River, flow either directly or indirectly into Lake Winnipegosis, which in turn, feeds into Lake Manitoba through the Waterhen River. The Whitemud River enters the lake on its southwest shore at Lynchs Point, north of the community of Westbourne. Lake Manitoba drains through the Fairford River through the south end of Pineimuta Lake into Lake St. Martin, then through the Dauphin River east to Lake Winnipeg.

Other water bodies of significance in the basin include Dauphin Lake, Swan Lake and Red Deer Lake in the west, Ebb and Flow Lake near the west shore of Lake Manitoba, and Dog Lake on the eastern side.

Land use in the southern and southwestern portions of the basin below the Manitoba Escarpment – from Duck Mountain south – is primarily agricultural with a combination of intense annual crop production and mixed farming. Nearer to the west shore of Lake Manitoba, the emphasis shifts to livestock production, primarily cow/calf operations. Agricultural land use in the Interlake region focuses on mixed farming with an emphasis on livestock, forage and forage seed production.

Throughout the northern portion of the basin – north and west of Lake Manitoba – the landscape is largely in its natural state, except for some mixed agriculture in the Swan River/Birch River area. Cow/calf production is the primary agricultural activity in isolated areas along the northern sections of Lake Manitoba, including Peonan Point, the Waterhen area and in the vicinity of Lake St. Martin.

Forestry activity in the basin revolves around supplying hardwood timber for the Louisiana-Pacific plant in Minitonas which produces oriented strand board for the construction industry. Most of the northwestern portion of the basin – from Lake Manitoba and Lake Winnipegosis north of a line roughly through Alonsa and Dauphin to the Saskatchewan border – has been under a Forest Management Licence to the company since 1994.

Figure 2.1: Lake Manitoba Drainage Basin

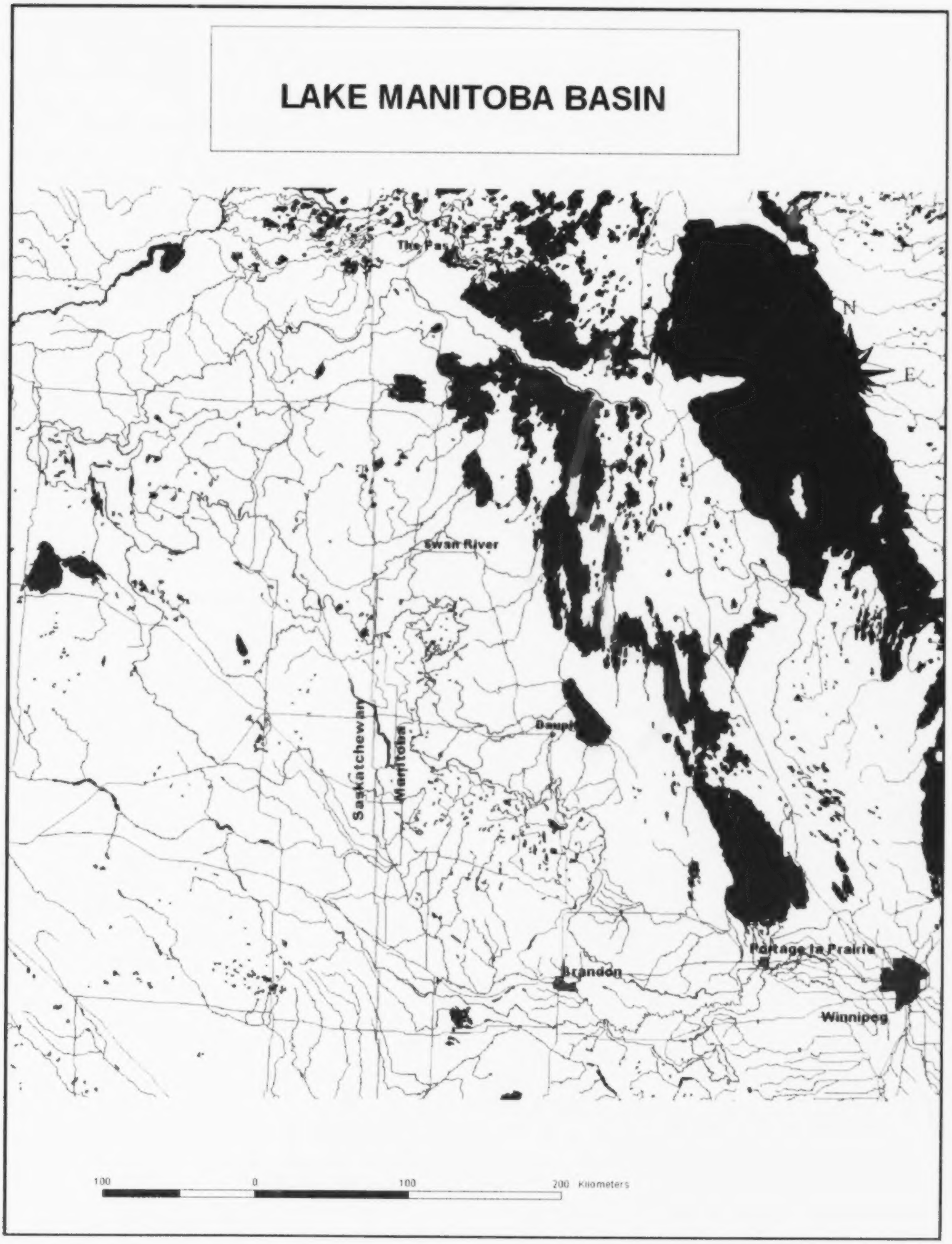
LAKE MANITOBA BASIN
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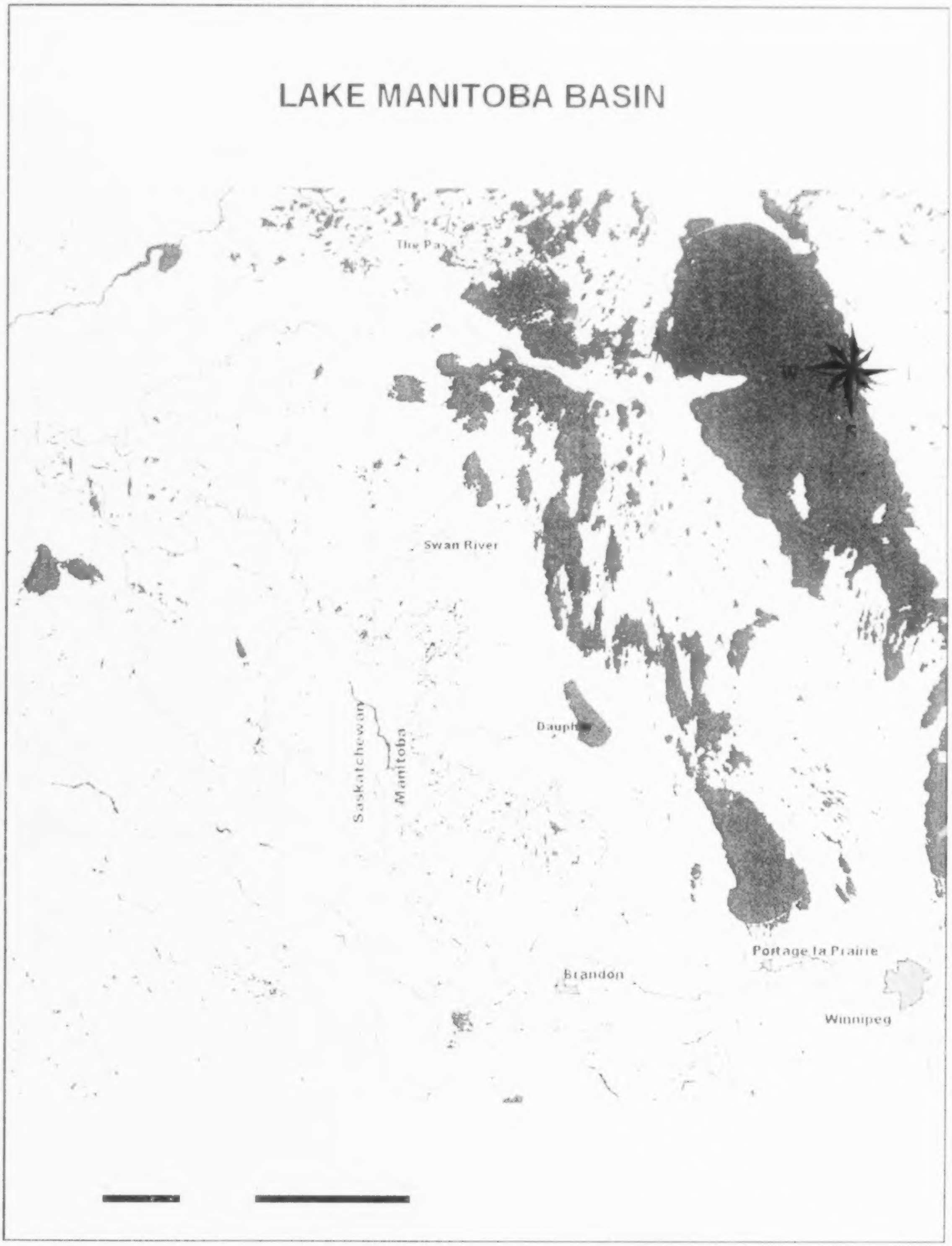
Figure 2.1: Lake Manitoba Drainage Basin


LAKE MANITOBA BASIN
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Saskatchewan
Manitoba
Dauphin
Portage la Prairie
Brandon
Winnipeg

2.1.1 Lake Winnipegosis

Lake Winnipegosis is the 29th largest freshwater lake in the world[2] with an area of 5,400 km². It has a maximum depth of 18 metres.

Lake Winnipegosis receives most of its water from rivers and streams running off the highlands of the Manitoba Escarpment. The major streams in the northwest include the Overflowing, Red Deer and Swan rivers. In the Riding Mountain and Duck Mountain areas, the Valley, Vermillion, Turtle, Ochre and Wilson rivers discharge into Dauphin Lake. From there, water flows through Mossey River, emptying into Lake Winnipegosis at the community of Lake Winnipegosis.

The only outlet from Lake Winnipegosis is through the Waterhen River into the north basin of Lake Manitoba.

2.1.2 Lake Manitoba

Slightly smaller than Lake Winnipegosis, Lake Manitoba is the 33rd largest lake in the world[3] with a surface area of about 4,700 km².

Lake Manitoba is 225 kilometres (km) long from north to south and has 915 km of shoreline. It is divided naturally into north and south basins at the Lake Manitoba Narrows, located approximately half way along its length near the community of Eddystone. Lake Manitoba has water depths averaging about five metres with a maximum depth of about seven metres.

The south basin is broad and shallow, about 40 km across at its widest point. The shoreline is primarily sand and clay derived from lacustrine deposits and glacial till. The lake bottom is generally soft and silty. The northern basin shoreline is more irregular, being influenced by bedrock with some prominent limestone bedrock outcrops. The lake bottom is more rocky and gravelly than the south basin. The only outlet from Lake Manitoba – the Fairford River – exits the lake on the northeast corner of the north basin into Lake St. Martin.

Lake Manitoba receives the majority of its water from Lake Winnipegosis. Other contributions come from the Whitemud River, artificial drains, intermittent streams and groundwater, and from overland runoff. During flood years on the Assiniboine and/or Red rivers, the Portage Diversion also contributes water to Lake Manitoba. Completed in 1970, the Diversion connects the Assiniboine River to Lake Manitoba from a point immediately west of the city of Portage la Prairie to south shore of Lake Manitoba at the Delta Marsh.

The hydrology of Lake Manitoba and connecting systems, including the Portage Diversion, will be discussed further in Section 4.0.

2.1.3 Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River

The Dauphin River drainage basin includes all of the Lake Manitoba basin and the lands draining into the Fairford River, Pineimuta Lake and Lake St. Martin. Lake Manitoba drains through the Fairford River at Pinaymootang (Fairford) First Nation, then through the south end of Pineimuta Lake into Lake St. Martin. Over the years, control structures have been built on the Fairford

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[2] Manitoba Water Branch, in its presentation to the Committee, November 2001.

[3] Ibid

River with the intent of managing water levels on Lake Manitoba by restricting or increasing the amount of flow from Lake Manitoba into Lake St. Martin. There are no control structures on the outlets of either Pineimuta Lake or Lake St. Martin.

Pineimuta Lake is a shallow, 39 km^2 wetland complex situated between Lake Manitoba and Lake St. Martin. The area, especially the southern portion, is comprised of deltaic deposits formed through centuries of deposition from floodwaters passing through the area.

Lake St. Martin has a total surface area of approximately 345 km^2 with about 260 km of shoreline[4]. It is comprised of two shallow basins – the larger having a maximum depth of about four metres, the smaller 1.5 metres. Lake St. Martin drains northeastward through the Dauphin River. The Dauphin River is approximately 50 km long, emptying into Sturgeon Bay on Lake Winnipeg. The drop in elevation from Lake St. Martin to Lake Winnipeg is in the order of 27 metres. The difference in elevation between Lake Manitoba and Lake St. Martin is approximately four metres.

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[4] Manitoba Water Commission, October 1978. Lake St. Martin and Pineimuta Lake Regulation.

2.2 Lake Manitoba – The Study Area

2.2.1 Population and Economic Base

Rural municipalities (RMs) bordering Lake Manitoba include (listed clockwise from the northeast) Grahamdale, Siglunes, Eriksdale, Coldwell, St. Laurent, Woodlands, Portage la Prairie, Westbourne, Lakeview, Lawrence and Alonsa. (Figure 2.2: Municipalities, Towns, First Nations communities) The population of these municipalities, excluding First Nation communities, and Census Division No. 19, most of which lies outside of the basin, totals about 22,000 (Table 2.1: Municipal population statistics). Of that, approximately 5,500 reside in the RMs of Westbourne and Woodlands, two municipalities that account for a very small percentage of the shoreline in the south basin. While the RM of Portage la Prairie (pop. 6,791) borders most of the south end of Lake Manitoba, only a small portion of the municipality, and the associated population, is located within the Lake Manitoba Drainage Basin.

There are five First Nation communities directly bordering Lake Manitoba – Sandy Bay, Ebb and Flow, Crane River (O-Chi-Chak-Ko-Sipi First Nation), Dog Creek (Lake Manitoba First Nation) and Fairford (Pinaymootang First Nation). Fairford also extends inland to the shores of Pineimuta Lake and Lake St. Martin.

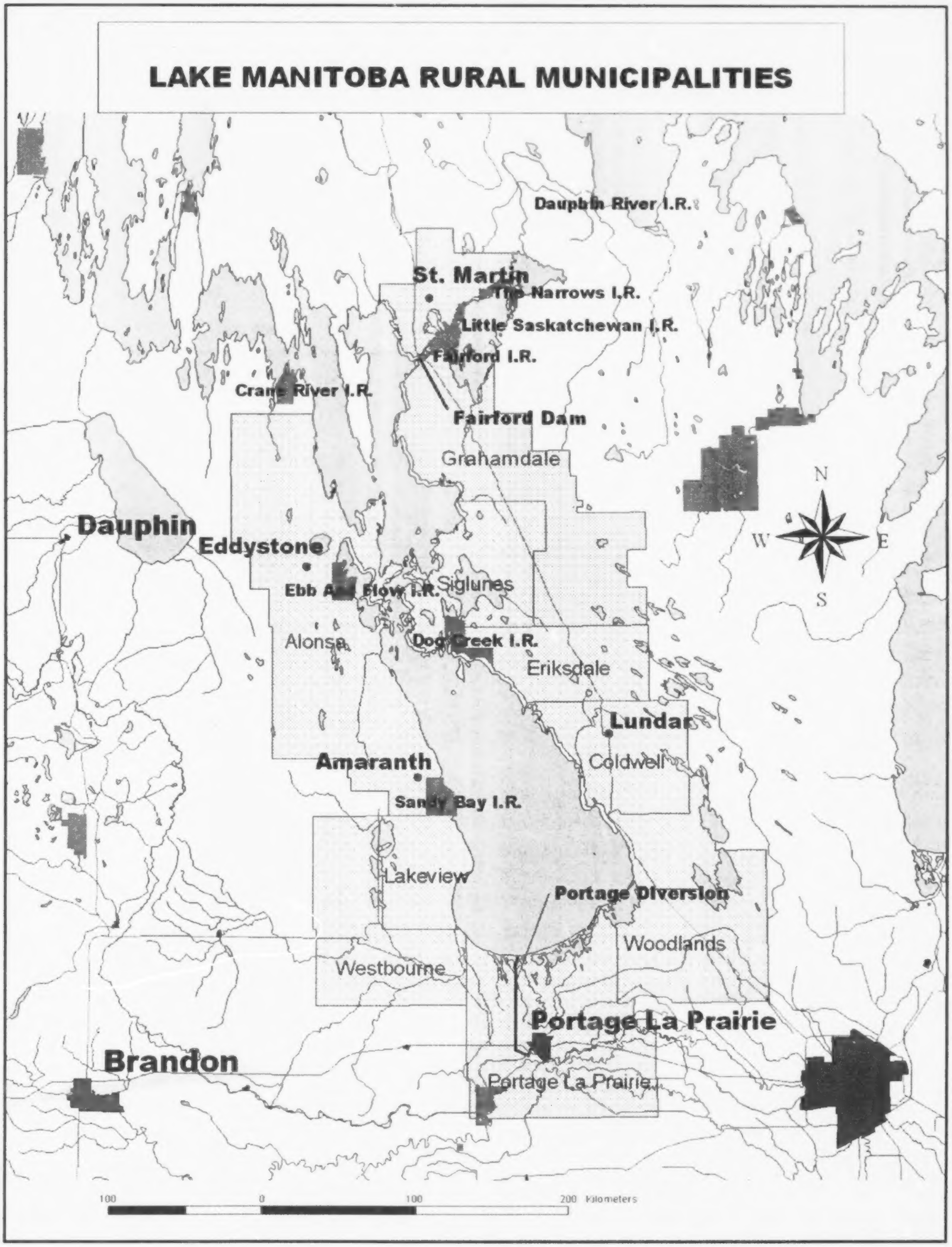
In addition, there are three other First Nation communities downstream of the outlet from Lake Manitoba into the Fairford River. These include Little Saskatchewan and The Narrows (Lake St. Martin First Nation), both bordering Lake St. Martin, and Dauphin River, which is located at the mouth of the Dauphin River on Lake Winnipeg.

According to Indian and Northern Affairs Canada First Nation profiles, the combined First Nations population resident in the area adjacent to Lake Manitoba and downstream of the Fairford River Water Control Structure is nearly 8,900 (Table 2.2: First nations populations). Sandy Bay First Nation, near Amaranth, is the largest community along the western shore of the lake with more than 3000 residents. Other communities on the west side of the lake include Alonsa, Amaranth and Langruth. The city of Portage la Prairie is located about 30 km south of Lake Manitoba, just outside of the drainage basin.

Communities on the east side of the lake include St. Laurent, Lundar, Lake Manitoba First Nation (Dog Creek I.R.) and Steep Rock. In total, about 3,200 First Nation peoples reside in the four communities adjacent to and downstream of the Fairford River Water Control Structure. Ashern, about 16 km east of the lake, is a major service center for the Interlake portion of the drainage basin.

Much of the area surrounding the most northerly portion of Lake Manitoba (north of the RMs of Grahamdale and Alonsa) lies within the unincorporated territory and Canada Census Division No. 19. Population in this area, which includes the communities of Crane River (excluding O-Chi-Chak-Ko-Sipi First Nation), Mallard, Meadow Portage, Waterhen and Homebrook, is approximately 700. This estimate was derived by identifying the communities listed and using population estimates for each community.

Figure 2.2: Municipalities, towns and First Nations communities


LAKE MANITOBA RURAL MUNICIPALITIES
Dauphin River I.R.
St. Martin
The Narrows I.R.
Little Saskatchewan I.R.
Fairford I.R.
Crane River I.R.
Fairford Dam
Grahamdale
N
W
E
S
Dauphin
Eddystone
Ebb And Flow I.R.
Siglunes
Alonsa
Dog Creek I.R.
Eriksdale
Lundar
Coldwell
Amaranth
Sandy Bay I.R.
Lakeview
Portage Diversion
Woodlands
Westbourne
Portage La Prairie
Brandon
Portage La Prairie
100
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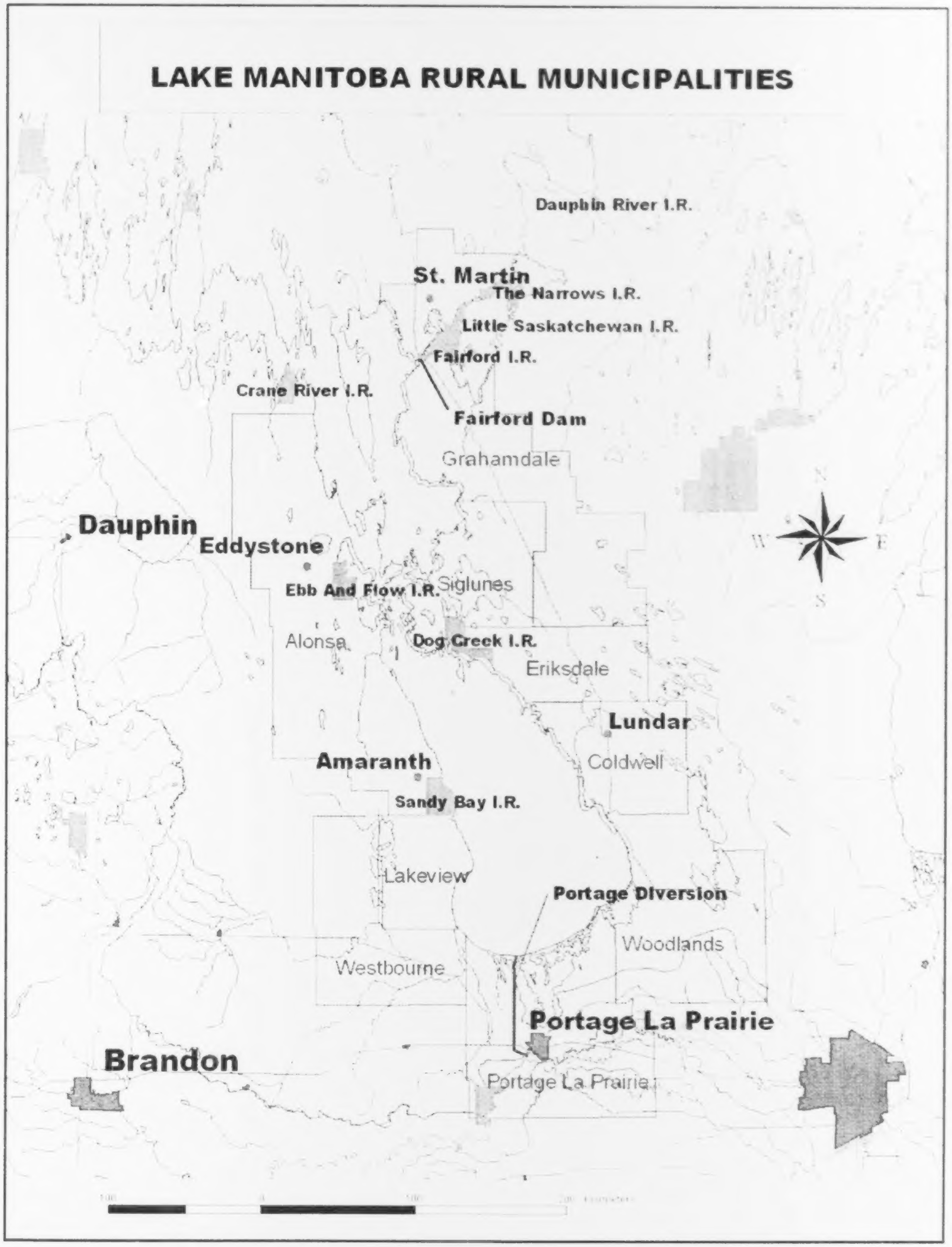
200 Kilometers

Figure 2.2: Municipalities, towns and First Nations communities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Ebb And Flow I.R.
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Alonsa
Dog Creek I.R.
Eriksdale
Lundar
Coldwell
Amaranth
Sandy Bay I.R.
Lakeview
Portage Diversion
Woodlands
Westbourne
Portage La Prairie
Brandon
Portage La Prairie

Table 2.1 Municipal population statistics (Source: Statistics Canada census data, 1996 and 2001)

Municipality	1996 Population	2001 Population	Percent change	Number of dwellings (2001)[1]	Total assessed value of property (2000)[2]
Alonsa	1769	1641	-7.2	747	$75,827,700
Census Division No. 19	3521	3217 (700)[3]	-8.6	2904	Not available
Coldwell	1399	1320	-5.6	697	54,319,300
Eriksdale	942	889	-5.6	418	33,346,400
Grahamdale	1625	1500	-7.7	874	71,723,100
Lakeview	407	384	-5.7	259	23,530,700
Lawrence	608	540	-11.2	312	32,645,600
Portage la Prairie	6627	6791	+2.5	2553	533,603,200
St. Laurent	1020	1172	+14.9	1324	61,000,200
Siglunes	1585	1513	-4.5	804	63,303,600
Westbourne	2035	2017	-0.9	635	125,641,500
Woodlands	3457	3453	-0.1	1311	183,773,100
Totals	24,995	24,437 (21,920)[3]	-2.3	12,838	$1,258,714,400

1. Total number of dwellings includes cottages
2. Source: Province of Manitoba, Intergovernmental Affairs: Community Profiles
3. Census Division No. 19 includes a vast area of central Manitoba. Estimated population within the area surrounding Lake Manitoba is about 700.

Table 2.2: First Nations Populations as of June, 2003
(Source: Indian and Northern Affairs Canada, First Nation Profiles)

First Nation	Registered Residents	Registered non-residents	Total Registered
Dauphin River	131	120	251
Ebb and Flow	1111	892	2003
Lake Manitoba	1131	443	1574
Lake St. Martin	1279	653	1932
Little Saskatchewan	556	384	940
O-Chi-Chak-Ko-Sipi	425	321	746
Pinaymootang	1193	1142	2335
Sandy Bay	3041	1756	4797
Totals	8867	5711	14,578

The economy of the area is based primarily on agriculture and resource-based industries such as commercial fishing, and on service industries (Tables 2.3 and 2.4). The dominant agricultural activity is ranching, primarily cow/calf operations. The commercial fishing industry is the third largest in the province. While commercial forestry plays a significant role in the western part of the drainage basin, it is not as prominent nearer Lake Manitoba. Some mineral extraction takes place, notably gypsum mining at Harcus, near Amaranth, and lime production at Faulkner, near Steep Rock.

Service industries provide support to local industries and activities as well as to a healthy tourism industry. Tourism focuses on water-based recreation and the sport fishing and hunting industries, which support many local individuals and businesses servicing these activities.

Table 2.3 Income and labour data by Rural Municipality, 1996
(Source: Statistics Canada, 1996 census data)

Municipality	1996 Population	Total Persons reporting work between Jan. 1/95 and census date	Agr. & Res. (1)	Manu. & Cons. (2)	Service Industries	Average Income
Alonsa	1,769	760	355	45	360	$13,268
Census Division No. 19	3,521	1060	395	75	585	13,449
Coldwell	1,399	730	220	115	390	16,712
Eriksdale	942	410	100	40	240	19,341
Grahamdale	1,625	850	315	85	445	15,666
Lakeview	407	265	145	15	105	17,901
Lawrence	608	300	175	10	110	12,320
Portage la Prairie	6,627	3,600	1,160	455	1,980	21,022
St. Laurent	1,020	450	110	150	190	17,216
Siglunes	1,585	770	205	70	500	14,536
Westbourne	2,035	1,050	560	65	420	18,185
Woodlands	3,457	1,875	525	305	1,040	19,615
Totals	24,995	12,120	4,265	1,430	6,365	$16,603

Census Division No. 19 includes a vast area of central Manitoba. Estimated population within the area surrounding Lake Manitoba is about 700.

(1) Agriculture and Resource-based Industries. (2) Manufacturing and Construction Industries

Table 2.4 Income and labour data by First Nation, 1996
(Source; Statistics Canada, 1996 census data)

First Nations Community	Total Persons reporting work between Jan. 1/95 and census date	Agr. & Res. (1)	Manu. & Cons. (2)	Service Industries	Average Income
Dauphin River	40				N/A
Ebb and Flow	220	55	15	145	$9,409
Lake Manitoba	135	-	10	130	8,628
Lake St. Martin	205	10	10	185	9,756
Little Saskatchewan	130	-	10	125	11,165
O-Chi-Chak-Ko-Sipi	130	10	-	120	9,991
Pinaymootang	190	10	15	170	9,991
Sandy Bay	395	25	25	345	10,392
Totals	1,445	110	85	1,220	$9,905

2.2.2 Landforms and Soils

Lake Manitoba straddles two ecoregions – the Lake Manitoba Plain Ecoregion which is part of the Prairies Ecozone, and the Interlake Plain Ecoregion, located within the Boreal Plains Ecozone.[5]

The Lake Manitoba Plain Ecoregion encompasses the south basin of Lake Manitoba. The southern shoreline and a portion of the southwestern shore are bordered by a level to very gently sloping alluvial and glacio-lacustrine plain – a remnant of the glacial Lake Agassiz lakebed. The clay and clay-loam soils in this area are very fertile and productive for a wide range of crops.

The remaining landscape surrounding the south basin is dominated by a ridge and swale topography that trends north to south. Ridges vary from 400 to 800 m wide with the swales, or depressions, up to 800 m wide. These features inhibit the natural east-west movement of water across the landscape.

The tops of the ridges are generally gravelly and cobbly while the swales have finer-textured deposits. Soils that have developed on the ridges are generally shallow, highly calcareous and stoney. Soils in the swales are poorly drained, many with a thin layer of peat on the surface.

The entire area is underlain by relatively flat-lying layers of limestone bedrock. In the area surrounding the south basin, the thickness of glacial deposits over bedrock can vary from as shallow as 10 centimetres (cm) to as deep as 30 m.

The north basin of Lake Manitoba is located within the Interlake Plain Ecoregion. The landscape in this area is also dominated by ridge and swale topography. Generally speaking, soil profiles tend to be shallower, and limestone bedrock outcrops more common than in the region of the south basin. Soils are generally stony and poorly drained.

The area surrounding Lake St. Martin is a level to ridged till plain partly covered with a thin veneer of glacio-lacustrine clay. However, stoniness, poor internal drainage and low fertility limit soil productivity for agriculture. The exception is in the immediate area of Pineimuta Lake which, because of its origin of centuries of soil deposition from floodwaters, soils are relatively fertile although they are subject to wetness.

2.2.3 Climate and Vegetation

Over the two ecoregions within which Lake Manitoba is situated, the climate is characterized by relatively short, warm summers and long, cold winters. Total annual precipitation amounts vary according to location, but in all instances, about one-quarter of the water equivalent falls as snow. (See Table 2.5) Average yearly moisture deficits (for agriculture) over the area range from 85mm to 190mm.

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[5] Information presented regarding landforms, soils, climate and vegetation has been adapted from "Terrestrial Ecozones, Ecoregions and Ecodistricts of Manitoba" prepared by the Land Resource Unit, Research Branch, Agriculture and AgriFood Canada, Winnipeg; Printed in 2000.

Table 2.5: Climate data for Delta Marsh and Ashern (Canadian Climate Normals, 1971 – 2000, Atmospheric Environment Service, Environment Canada)

Location	Mean annual temperature	Mean July temperature	Mean January temperature	Total annual precipitation	Degree days above 5^0C
Delta Marsh	2.1 C	19.1 C	-18.0 C	524.6 mm	1,713.8
Ashern	1.3 C	18.4 C	-19.3 C	499.9 mm	1,587.6

The native vegetation in the Lake Manitoba Plain Ecoregion is generally a mixture of trembling aspen and grassland with bur oak and grasses on coarser, better-drained soils. On wetter sites, balsam poplar is often mixed with aspen. Shrubs include hazelnut, pincherry, saskatoon, rose and dogwoods. Marshlands support slough grasses, reeds and sedges, and salt-tolerant plants where salinity is a problem.

Natural vegetation in the Interlake Plain Ecoregion is dominated by aspen/poplar stands interspersed with white spruce on imperfectly drained till and glacio-lacustrine soils. Jack pine may be found on drier sites. The occurrence of conifers increases toward the northern limits of the area. Poorly drained sites have willow, sedge and meadow grasses with some tamarack and black spruce in more northerly areas.

2.2.4 Agriculture

Agriculture immediately surrounding Lake Manitoba and Lake St. Martin is heavily influenced by the productive capability of the soils and the limitations imposed by natural conditions. Soil capability for agriculture varies markedly from south to north along Lake Manitoba.

South of Delta Marsh, Canada Land Inventory capability classes for agriculture are dominated by Class 1 and Class 2 soils – soils with only minor limitations to the production of annual crops. Around the southwest side to the Langruth area, Class 2 soils are also common. However, from Amaranth north, limitations to crop production generally increase with classes 3 and 4 becoming dominant due to soil conditions such as wetness and stoniness. North of the Narrows, classes 4, 5 and 6 with wetness and stoniness are most common.

Along the east side of the lake from the south to the Narrows, classes 3 and 4 are dominant. North of the Narrows, classes 4 and 5 are most common with scattered pockets of Class 3 soils. In the Lake St. Martin area, classes 4, 5 and 6 soils dominate, with wetness and stoniness the most common limitations. However, there are pockets of Class 3 soils in the area surrounding Lake St. Martin and Pineimuta Lake that could support some annual cropping if they are not subject to excess moisture.

Agricultural land use patterns reflect the capability of the land. See Table 2.6 for a summary of agricultural land use for the municipalities surrounding the lake.

Wherever agricultural activity borders on the shores of Lake Manitoba, Lake St. Martin and their associated bays and marshes, livestock production dominates. The beef industry is a major, if not the largest, economic contributor to many communities surrounding the lakes. Not only do the lakes provide a source of water for livestock, the shorelines and wetlands provide grazing, and perhaps more importantly, a valuable source of native hay.

Table 2.6: Land Use by Municipality, 2001
(Manitoba Agriculture, Policy and Economics Division)

Municipality	Area of Municipality (ha)	Total Farm Area (ha)	Tame Pasture (ha)	Native Pasture (ha)	Other Agricultural Use (ha)*
Alonsa	297,750	230,585	8,342	144,431	77,812
Census Division No. 19	6,121,694	113,860	3,579	47,899	62,382
Coldwell	90,184	71,071	2,371	34,669	34,031
Eriksdale	78,476	45,392	3,339	17,385	24,668
Grahamdale	240,000	116,691	6,477	60,295	49,919
Lakeview	56,787	30,098	2,282	9,624	18,192
Lawrence	76,164	74,856	2,883	35,004	36,969
Portage la Prairie	196,455	160,452	5,227	21,140	134,085
St. Laurent	46,251	23,316	704	12,035	10,577
Siglunes	83,742	83,434	3,523	42,305	37,606
Westbourne	126,179	118,702	8,400	18,526	91,776
Woodlands	116,063	103,505	5,061	40,070	58,374
Totals	7,529,745	1,171,962	52,188	483,383	636,391

*Other agricultural use includes cropland, summerfallow and unimproved land.

Table 2.7: Cattle producers and cattle populations by municipality, 2001
(Manitoba Agriculture, Policy and Economics Division)

Municipality	Total Farms	Total Gross Receipts (all farm products)	Farms with Cattle	Total Cattle
Alonsa	272	$23,022,732	234	47,770
Census Division No. 19*	124	7,672,122	99	20,057
Coldwell	131	12,148,161	103	16,934
Eriksdale	102	7,282,337	78	11,558
Grahamdale	200	15,168,972	156	31,146
Lakeview	69	8,587,519	48	7,213
Lawrence	122	8,670,599	98	15,875
Portage la Prairie	460	127,004,784	201	20,635
St.Laurent	49	2,277,106	35	5,125
Siglunes	133	11,819,229	113	23,859
Westbourne	288	59,171,169	191	26,981
Woodlands	293	45,197,055	194	32,369
Totals	2,243	$328,021,785	1,550	259,522

* Census Division No. 19 includes Peonan Point, Crane River, Waterhen and other communities.

Table 2.7 displays the numbers of farms and total cattle populations for all municipalities surrounding the lake. Manitoba Agriculture's Policy and Economics Division records farm statistics by municipality, but does not provide more detail. Therefore, it is unknown how many of these producers own or lease lakeshore land.

Note that the municipalities of Woodlands, Portage la Prairie and Westbourne in combination represent more than 70 per cent of the gross receipts of the total. This reflects land capability, associated land use and the percentage of the municipality under agricultural production.

2.2.5 Recreation and Cottaging

Recreational activities around Lake Manitoba focus on water-related activities such as sport fishing and waterfowl hunting, bird watching, camping, swimming, boating and related activities, and cottaging.

There are four Provincial parks (St. Ambroise, Lundar Beach, Lynchs Point and Manipogo) and one Provincial campground (Watchorn) along the shores of the lake. Weekend camping and day use activities are popular along public beaches at many of these locations as well as others. In addition, there are a number of privately owned campgrounds and resorts, some of which cater primarily to the sport fishing and hunting population. Commercial enterprises along the southern shore of the lake, at the Narrows and near Fairford provide examples.

Cottaging is an important use of the Lake Manitoba shoreline. (Table 2.8: Cottage Properties along Lake Manitoba.) The main concentration of cottage development occurs along the south and southeastern shores from Lynchs Point to St. Laurent with nearly 1100 properties in this reach. The remaining cottages are located at scattered locations around the lake.

Changing lifestyles, the growth in the number of "Baby Boomers" going into retirement and technology that allows individuals to work from their own homes has resulted in an increasing number of cottages becoming full-time homes. For example, in a presentation to the Committee, the Lundar Beach/Sugar Point Cottage Owners Association indicated that 15 such homes now exist in their area with five more planned for construction in the following two years. In addition, there are an estimated 15 permanent residences along Delta Beach.

These properties, while providing summer retreats or permanent homes for their owners also provide revenues to municipalities and incomes for local businesses. For example, according to one municipal source, approximately 50 per cent of the total municipal assessment for the RM of St. Laurent is derived from cottage properties.

Table 2.8: Cottage Properties Along Lake Manitoba
(Information provided in collaboration with the municipalities)

Municipality	Total number of lakeshore properties (Approximate)	Subdivision name (Approximate number of lakeshore properties)
Alonsa	30	Urban Homes (20)
		Manitowapa (10)
Census Division No. 19	200	Waterhen (N/A)
		Woods Creek (20)
		Benyk's Point (40)
		Hill's Resort (87)
		Janttil's Resort (50)
Grahamdale	100	Maple Beach (20)
		Steep Rock and Elm Point (50)
		Schroeder's (14)
		Dayton (16)
Siglunes	167	The Narrows (43)
		Silver Bay (38)
		Oriole/Freeman (35)
		Jonasson (22)
		Oak Bay Lodge (24)
		Robert Geisler (5)
Eriksdale	None	None
Coldwell	65	Lundar Beach (40)
		Sugar Point (25)
St. Laurent	775	Twin Lakes Beach (250)
		Sand Piper Estates/Lake Manitoba Estates (300)
		Pioneer Beach (50)
		Laurentia Beach (150)
		Johnson Beach (25)
Woodlands	50	Twin Lakes Beach (50)
Portage la Prairie	275	Delta Beach (275)
Westbourne	None	None
Lakeview	None	None
Lawrence	38	Manipogo (38)
Total	1700	

2.2.6 Commercial Fisheries

While First Nations and Metis people had been feeding the Red River Settlement with whitefish netted from the near-shore areas of Lake Manitoba since at least the mid-1860s[6], the first data on the extent of the commercial fishery on the lake comes from 1885. In that year, at least 154,200 kilograms (kg) of fish were shipped to markets as far away as New York and Chicago[7]. Whitefish and jackfish were the most common species caught at that time with pickerel and tulibee being less frequent. As the demand for Manitoba fish grew, the industry grew.

With the growth of the industry came controversy. Concerns over possible depletion of fish stocks through over-exploitation, especially by high volume fishing companies, prompted the federal government, in early March, 1905 to close Lake Manitoba, along with Lake St. Martin, Waterhen, Dog and Shoal lakes to summer commercial fishing. Other than a fishery for coarse fish (carp, suckers) at Clandeboye and Delta at the south end of Lake Manitoba, which started in 1964, the lake has never re-opened for summer commercial fishing. However a vigourous winter fishery persisted. (The Lake St. Martin coarse fish commercial fishery was also re-opened.)

In 1921, 335 fishers sold 864,000 kg of fish[8]. The number of fishers and the size of the catch increased each year thereafter to 1925, when 905 individuals caught 2,364,000 kg. From 1932 to 1934, the number of fishers on the lake ranged from 640 to 789 annually, with catches between 1.9 million and 2.3 million kg[9]. Major species during this period were perch, pickerel, tullibee and suckers. Whitefish, which had been common three decades earlier, were comparatively rare.

Over time, dog teams and horse-drawn fish sleighs were replaced with bombardiers and snowmobiles. Technological innovations such as powered ice augurs, stronger and tougher net materials (first linen, then cotton, and finally a range of plastics) evolved. Net designs less prone to tangling were developed, and smaller mesh sizes and jiggers introduced. Refrigeration facilities were improved. All this should have, in theory, enabled larger catches by fewer fishers with less effort. Yet, the number of people engaged in the Lake Manitoba fishery remained around 800 annually, while the total catch declined from between 2.3 and 2.7 million kg annually in the 1950s and early 1960s to around 910,000 kg in the 1970s.

Today, in terms of commercial fishing, Lake Manitoba is primarily a winter fishery. Economically, perch, pickerel and sauger are the most important species. While tulibee are still plentiful, there is currently little market demand. The summer fishery produces only carp and mullet. Almost all fish caught in the area are packed locally and shipped to Winnipeg for processing. Local delivery points are Amaranth, Ashern, Crane River, Delta, Eddystone, Langruth, Lundar, St. Ambroise, St. Laurent, Skownan, St. Martin, Vogar and Winnipegosis.

During the 10-year period from 1990/91 to 1999/00, average annual fish production from Lake Manitoba, summer and winter seasons combined, was just under 1.6 million kg. (Manitoba Conservation, Fisheries Branch data) This ranked third in the province in terms of total weight behind the Northern Lakes[10] (2.7 million kg) and Lake Winnipeg (4.8 million kg), and slightly ahead of Lake Winnipegosis (1.5 million kg). Total annual value for that period (in 2001 dollars) averaged about $3.1 million.

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[6] Hargrave, J.J., 1871. (Reprinted 1977) Red River. 506 pages.

[7] Einarsson, H. 1982. Helgi Einarsson: A Manitoba Fisherman. Translated by G. Hauser. Queenston House, Winnipeg. 147 pages.

[8] National Archives of Canada, Winnipeg office. Public Works files, Accession W84-85/493 Box 20 Lake Manitoba/Dog Lake. Canada Department of Marine and Fisheries, internal report dated 31 May 1926.

[9] Manitoba Dept. Mines and Natural Resources, Annual Reports, 1933 & 1935.

However, when winter fisheries are considered alone, Lake Manitoba is the largest of all winter fisheries in the province in terms of an annual catch of nearly 1.3 million kg (1991-2000). This represents just over 30 per cent of the total winter fishery in Manitoba.

For the three-year period 1999/2000 to 2001/2002, total winter production by weight ranged from about 1.3 million kg to more than 1.8 million. (See Table 2.9) Notable is the increase in the deliveries of perch in 2001/2002 (444,279 kg).

Table 2.9: Total commercial fish catch Lake Manitoba, 1999-2000 to 2001-2002 Winter Seasons (based on deliveries in kilograms) **Source: Manitoba Conservation, Fisheries Branch**

Species	1999-2000	% of catch	2000-2001	% of catch	2001-2002	% of catch
Bass	Trace	-	No Info.	-	No Info.	-
Carp	84,050	6.4	158,550	10.6	74,942	4.0
Mullet	689,250	52.5	804,045	53.7	1,050,794	56.3
Perch	83,650	6.4	85,788	5.7	444,279	23.8
Pickerel	307,500	23.5	370,596	24.7	236,008	12.6
Pike	86,900	6.6	54,594	3.6	47,829	2.6
Sauger	57,500	4.4	25,453	1.7	13,619	0.7
Whitefish	3,000	0.2	No Info.		No Info.	
Total (kg)	1,311,850	100	1,499,026	100	1,867,471	100

Between 1990 and 2000, there was an average of 545 commercial fishing licenses on Lake Manitoba each year. The number of individuals employed in the Lake Manitoba fishery – licensed fishers and helpers combined – averaged 934. The average annual income for fishers is the lowest in the province on Lake Manitoba and Lake Winnipegosis at $3,354 and $3,757 respectively.[11] The provincial average is $7,032.

Lake St. Martin has been an important winter fishery since 1905. The primary species caught is whitefish. Whitefish from Lake Winnipeg spawn in the lake in the fall and are still in the lake when the fishery opens after freeze-up. Pickerel is also an important species to this fishery. The Dauphin River is an important spawning ground for the local fishery.

During the 21-year period from 1955/56 to 1975/76, landings of all species during the winter fishery on Lake St. Martin averaged 114,043 kg.

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[10] Fisheries Branch combines all northern lakes into one category for reporting purposes. These lakes include Moose Lake, Cross Lake, Split Lake, South Indian Lake, Reindeer Lake and many others.

[11] Average annual incomes were calculated using gross revenues and the total number of individuals employed in the fishery as indicated on all licenses. In fact, the number of licenses actually active in a given year is somewhat less than the total in effect. For example, the number of active licenses on Lake Manitoba in 2000/01 was 324; 2001/02 – 341. Accordingly, average annual incomes per person would be higher than this amount.

An important sport fishing industry also exists on Lake Manitoba, particularly around the Narrows, and downstream along the Dauphin River. A number of local businesses benefit from the annual influx of anglers from the rest of Manitoba as well as from other regions of Canada and the United States.

2.2.7 Wildlife

There are approximately 121,000 hectares (ha) of marshland along the shores of Lake Manitoba classified as highly to moderately productive for waterfowl (Canada Land Inventory, Ducks Unlimited). In 1973, the Manitoba Water Commission indicated that Lake St. Martin and Pineimuta Lake have about 7,700 ha of productive wetlands in their environs and 33,000 ha which are used as staging areas for waterfowl.

The remaining marshlands, while not as prolific in terms of producing broods, are important as moulting grounds and staging areas for waterfowl during migration. In addition to ducks and geese, other species of birds depend on the marshes and shoreline habitat for their existence.

The best known of the Lake Manitoba marshes is the internationally recognized Delta Marsh, a coastal marsh bordering the south end of the lake. Delta Marsh was designated as a "Wetland of International Significance" in 1982 under the Ramsar Convention and is a provincially designated "Heritage Marsh". Other major shoreline marshes on Lake Manitoba include Lynchs Point, Lake Francis, Marshy Point, Sugar Point, Big Point and Sandy Bay. Ebb and Flow Lake near Eddystone, although an entity unto itself, is connected to Lake Manitoba and is directly influenced by water levels on Lake Manitoba.

Five sites along Lake Manitoba have been designated, or are being considered for designation, as Important Bird Areas (IBA) under a national program. Six other important wildlife areas have been designated as Wildlife Management Areas (WMAs) by the Province (Figure 2.3: Wildlife Management Areas).

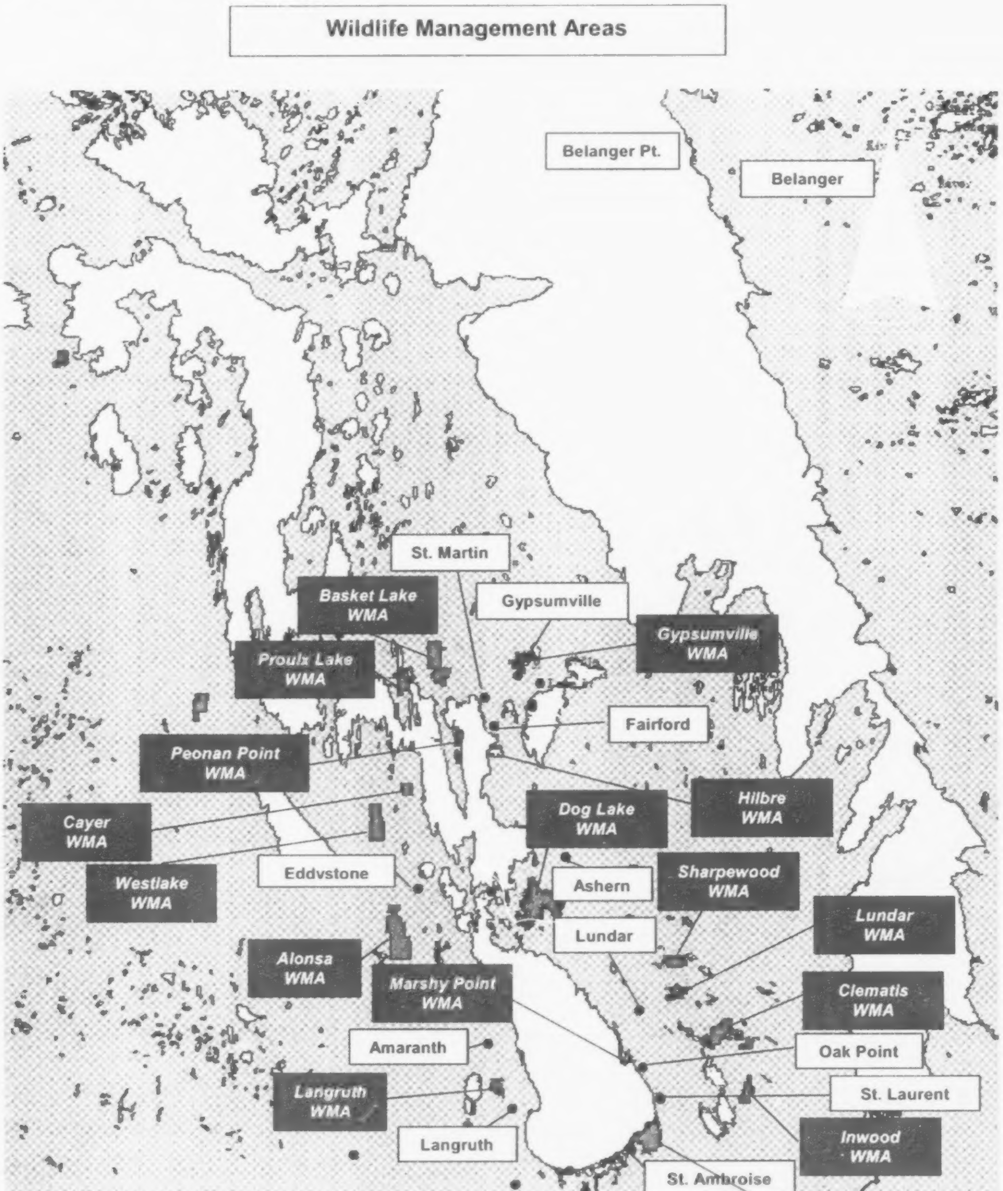
Delta Marsh, in addition to its other designations, has also been designated as an Important Bird Area. It is also a Game Bird Sanctuary. The Langruth/Lakeview IBA extends inland from Hollywood Beach and Big Point on the west shore of Lake Manitoba. The Kinosota/Leifur IBA also borders Lake Manitoba in the RM of Alonsa.

Marshy Point IBA (also a WMA) is situated just southwest of Lundar on the east shore of Lake Manitoba. Duck Island IBA (also known as Big Birch Island) is located in the northeast corner of the south basin of Lake Manitoba, just offshore from the Lake Manitoba First Nation.

In addition to Marshy Point, other Provincial Wildlife Management Areas include Lake Francis (a component of the Delta Marsh complex), Hilbre, Proulx Lake and Peonan Point.

At one time, wild fur trapping was a significant activity in the marshes bordering Lake Manitoba and in the Lake St. Martin area. Mink and muskrat were the most common furbearers. However, trapping activity has declined in recent years as a result of low prices and low furbearer populations.

Figure 2.3: Wildlife Management Areas


Wildlife Management Areas
Belanger Pt.
Belanger
St. Martin
Basket Lake WMA
Gypsumville
Gypsumville WMA
Proulx Lake WMA
Fairford
Peonan Point WMA
Hilbre WMA
Dog Lake WMA
Cayer WMA
Westlake WMA
Eddvstone
Ashern
Sharpewood WMA
Lundar
Lundar WMA
Alonsa WMA
Marshy Point WMA
Clematis WMA
Amaranth
Oak Point
Langruth WMA
St. Laurent
Langruth
Inwood WMA
St. Ambroise
Oakland
Lake Francis WMA
Portage la Prairie
0
0
100
200 Kilometer

3.0 Public Meetings – Summary of Presentations and Issues

3.1 Introduction

During April 2002, the Lake Manitoba Regulation Review Advisory Committee held public meetings at five locations – St. Martin, Lundar, Eddystone, Amaranth and Portage la Prairie. More than 25 presentations were made to the Committee during these public forums.

Numerous presenters expressed the view that regulating water levels on Lake Manitoba within the current, stable range is the source of many of their problems. Others felt the current regime was acceptable, in fact, preferred. Many of those appearing before the Committee pointed to the Portage Diversion as the reason for flooding problems and water quality concerns on Lake Manitoba. A number expressed concerns over the condition of the Fairford River Water Control Structure (FRWCS) and the manner in which it is operated. A number of those appearing before the Committee had concerns over the effectiveness of the fish ladder in the FRWCS.

Following is a summary of the points raised by presenters at each of the public meetings. The comments and points of view recorded within each of the presentation summaries below are those raised by the presenters themselves. The presentations may not necessarily appear in the order they were made to the Committee. Where copies of the presentations were made available to the Lake Manitoba Regulation Review Advisory Committee, they will be available at the Manitoba Legislative Library, 200 Vaughan Street, Winnipeg and at the Manitoba Conservation library.

3.2 April 2, 2002 – St. Martin

Rural Municipality of Grahamdale – Beverly Yaworski, Chief Administrative Officer

The RM of Grahamdale described the main issue as being the loss of land to the residents because of ever-changing lake levels. In addition to direct shoreline flooding, water that spills into swales and low areas adjacent to Lake Manitoba and Lake St. Martin during periods of high water does not drain away when lake levels recede.

In the opinion of the presenter, the land in the area is very valuable for producing forages – often at excellent yields and quality – to support the cattle industry in the area. Many feel this so-called marginal land is being sacrificed to the benefit of grain producers in the south and western portions of the basin. The municipality suggests the use of drop structures on agricultural drainage channels in the upper portion of the basin to help slow the movement of runoff water into Lake Manitoba and subsequently through the Fairford River.

The municipality also called for the construction of control structures on Pineimuta Lake, Lake St. Martin and the Dauphin River to help maintain water levels and flows on these water bodies during periods of low flows from Lake Manitoba. In the municipality's opinion, Lake St. Martin should be held between 799.0 and 803.0 ft asl and the FRWCS must be upgraded. The municipality calls for the immediate closure of the Portage Diversion until a plan of action for managing flows and water levels downstream of the FRWCS is completed by the Province. The plan they propose must include a financial commitment for the required works.

Mark Traverse, Lake St. Martin First Nation

During the discussion following the presentation on behalf of the RM of Grahamdale, Mr. Mark Traverse of the Lake St. Martin First Nation verbally raised a number of points regarding First Nations concerns downstream of the FRWCS. Following the public meeting, he provided a written submission to the Committee outlining the points he raised at the meeting, and expanded upon these. That written submission is summarized below.

Foremost among his suggestions was that the flow released through the FRWCS during the winter should be held at 1,100 cubic feet per second (cfs). This, in his opinion, provides the right amount of water for the winter fishery, especially the north end of Lake St. Martin. At lower flows, fishermen have problems with freezing nets. In addition, some downstream rapids will freeze to the bottom at lower flows, trapping fish in isolated pockets of water. When they become trapped, the lack of river flow and low oxygen levels often results in their death.

In regard to muskrats, Mr. Traverse pointed out that when Lake St. Martin reaches high levels in September, the muskrats build their houses accordingly. When water levels drop in October, the muskrats become frozen out, and set out to seek new homes, or die in the stranded ones.

Hayland in the area has often been flooded since the control structure was built and much of the land is now covered with bulrushes. Hay and grazing land made available as compensation for flooded lands is not as good as the original land.

He also raised a concern over water from the United States, and associated biota, being directed via the Souris River into the Assiniboine River, through the Portage Diversion into Lake Manitoba and eventually into Lake St. Martin.

Lake Manitoba Commercial Fishing Association – David Olson, Association member

The Lake Manitoba Commercial Fishing Association presentation outlined serious concerns over the use of Lake Manitoba as a catch basin for spring runoff and that the lake is drawn down in fall to make room for spring runoff from the Portage Diversion. They view the Diversion, and the water it conveys, as the single most important negative factor in water quality on Lake Manitoba. They recommended that the Diversion no longer be operated.

In the Association's opinion, the FRWCS has stopped the upstream movement of fish entirely. They suggested the structure be left open to allow fish movement, and only used in the most serious situations. A permanent, graduated sheet steel pile system in the lake at the mouth of the river should be used to manage the amount of water entering the river.

The Association recognized that fluctuating water levels are the key to the health of the ecosystem surrounding Lake Manitoba. They pointed out that the shoals and shoreline area of the lake provide the main spawning areas for fish, and not necessarily the creeks and streams flowing into the lake. Therefore, they suggested that spring water levels on Lake Manitoba be held between 811.0 to 812.0 ft asl to improve the survival of fish eggs and fry. Water levels higher than 812.0 ft asl could result in fry being stranded in isolated ponds on shore and upstream in creeks and ditches as the lake level recedes.

The Association also stated there must be enough water in the fall (in the Dauphin River and Lake St. Martin) to allow the whitefish to run and spawn. Water levels in Lake St. Martin must be maintained at a constant, adequately high level over winter to allow whitefish to survive and to minimize problems facing commercial fishers such as nets freezing beneath the ice.

Les Ivaniski (Local commercial fisher)

Mr. Ivaniski supported the Lake Manitoba Commercial Fishing Association's opinion that the FRWCS is an impediment to fish movement. He also made reference to a Manitoba Hydro study that examined the construction of a channel from Lake Winnipegosis to Lake Winnipeg to divert excess water.

Pinaymootang First Nation – Chief Garnet Woodhouse

The Pinaymootang First Nation (Fairford) claimed that constructing a dam on the Fairford River has flooded about one-half of the Reserve, some fronting on Lake Manitoba, the remainder around Pineimuta Lake, Lake St. Martin and along the Fairford River. Also, the operation of the FRWCS does not mimic natural conditions, resulting in unpredictable periods of flooding and drought.

Water quality is a major concern to the First Nation community. During high water the water table rises, or the land is flooded directly, saturating the soil and with it, septic tanks and water wells. A 1989 study conducted by Wardrop Engineering concluded that private wells throughout the community are contaminated and not suitable for drinking. The Pinaymootang First Nation asked that the operation of the Fairford River Water Control Structure be examined, and that First Nations be a part of the decision-making process.

Lake St. Martin First Nation – Myrle Traverse, Band member and LMRRAC member

In her presentation, Ms. Traverse reviewed the impact of the FRWCS on areas downstream. She also correlated flows on the Assiniboine River at Holland with water levels in Lake St. Martin, and water levels on Lake Manitoba with those on Lake St. Martin.

She noted that water level fluctuation downstream of the FRWCS has resulted in much of the land bordering Pineimuta Lake and Lake St. Martin becoming permanent swamp. Hunting, trapping and farming has been negatively impacted, as have roads and recreational facilities. The FRWCS has had a negative impact on the movement of fish.

Mould produced as a result of the wet conditions is a health hazard to people in the community. The local drinking water cannot be consumed; bottled water must be used. Access to traditional foods has been cut off.

The First Nations communities in the area advocate a natural lake level regime – that lake levels should not be altered. However, under the circumstances, the Province should seek First Nations permission to release water from Lake Manitoba. Collaboration is needed to reach solutions with upstream and downstream interests. Appropriate compensation should be provided for the loss of livelihood of local hunters, trappers and fishers.

3.3 April 4, 2002 – Lundar

Lundar Beach/Sugar Point Cottage Association – Jack Morrison, President

The Lundar Beach and Sugar Point Cottage Owners Association does not want the lake level lowered, fearing the growth of weeds and thus, the loss of their beach. The normal use of boats, canoes and jet skis would be severely restricted at low water levels. This could lead to a decrease in property values. Many old cottages are being replaced by permanent homes that contribute tax revenue to the municipality and the school division. The cottage owners may be prepared to live with natural fluctuations in water levels and a lower water level for a short period of time, but not over the long run.

Laurentia Beach Association – Ed Link, Past-president

The Laurentia Beach Association (representing about 200 properties) claimed low water levels in 2000 allowed the spread of weeds (northern watermilfoil) along their beach, threatening the entire bay area and raising concerns about possible reduction in property values. Cottage owners along this stretch of shoreline consider the 812.17 ft asl elevation as the best compromise for all. They do not support lowering the water level to help prevent shoreline erosion. They contend that the infamous November 1, 1999 storm was a once-in-a-lifetime event and water levels should not be managed for the relatively slight possibility of the re-occurrence of such an event.

Twin Lakes Beach Association – Dennis Turek, President

The Twin Lakes Beach Association holds the opinion the current operating level of Lake Manitoba is too high. They blame stable water levels of elevation 812.17 ft asl as the cause of erosion and deterioration of the beach ridge in the Twin Lakes area since it is not allowed to rebuild between storms. They recommended that water levels should not exceed 811.0 ft asl, suggesting that fluctuations are acceptable as long as they do not exceed 811.0. The impacts of lower water levels on beach rebuilding and health should be monitored over a period of time.

The Twin Lakes group said the FRWCS must be repaired to allow it to perform at capacity, especially when the Portage Diversion is in operation. In addition, the dikes along the Assiniboine River downstream from the Diversion gates should be repaired and upgraded to allow more flow and to reduce the necessity for the Diversion.

Lilly Schneider, Vice-president, Manipogo Golf and Country Club

She reiterated the concerns about shoreline erosion as pointed out by the Twin Lakes Beach Association, indicating that there is too much water in the basin. Since the golf course depends on beach tourism for traffic, their very livelihood is being threatened.

Ron Coley, P.Eng, Consultant

Ron Coley, a civil engineer and former general manager with Ducks Unlimited Canada, indicated that many stakeholders are unsatisfied with the current regulation. Flooding has affected Lake St. Martin negatively. The Portage Diversion and agricultural runoff have contributed to a deterioration in Lake Manitoba water quality. Native whitetop grass has been significantly reduced and higher water in late summer prevents hay harvesting in some areas. Many cottages are threatened by high water and the narrow range of water levels threatens marshlands.

He recommended that a trial water level regulation pattern be initiated as soon as possible on Lake Manitoba and applied for a minimum of eight years. The pattern would reproduce a three-year flood/drought cycle followed by a five-year period of normal levels, and would attempt to meet the requirements of all the stakeholders. It would provide seasonal and annual variations in order to reduce as much as possible, the negative impacts identified by each stakeholder group. The results should be monitored to help with regulation decisions in the future.

He also recommended repairing and properly maintaining the FRWCS. Water levels downstream from the Structure should be better managed. Steps to improve the water quality on Lake Manitoba should begin with more prudent operation of the Portage Diversion.

East Meadows Ranch – Kit Vincent
East Meadows Ranch is a 2,600 hectare portion of Marshy Point. East Meadows has conducted successful marsh management studies by isolating cells in the marsh and fluctuating the water levels artificially. There are radical differences in marsh health between the controlled area and the uncontrolled, with the controlled marshes considered to be much healthier.

There are gaps in data necessary for marsh management along the shores of Lake Manitoba, and disagreement among stakeholders on what direction to take. Stakeholders must agree on a procedure to solve this data shortfall and stop promoting special interests until enough data exists for informed decision-making. Further Marsh Ecology Research Program (MERP) research using the whole of Lake Manitoba, should be carried out to collect the proper scientific data to build a sound scientific foundation for the future. The project could run for eight years or so.

Mr. Vincent suggested broadening the Lake Manitoba Regulation Review Advisory Committee's terms of reference to allow for a multi-year data gathering process.

Manitoba Wildlife Federation – Larry Milian
Wildlife habitat has been adversely affected by fast overland run-offs and low water levels. Tourist hunting and hunting in general has suffered as a result. The Manitoba Wildlife Federation requested that wiidlife representatives be involved in the decision-making process concerning the regulation of Lake Manitoba.

W. John Johnson, cattle producer
Mr. Johnson indicated many farmers left his area after the high water of the 1950s. Subsequent lake level regulation has allowed him to stay on the farm. He stated that when the Portage Diversion is put into operation, the lake almost visibly rises. He called for a reduction in the extreme highs and lows in water levels, but would suggest a target level six inches lower.

Art Jonasson, cattle producer, and Mark Emilson, cattle producer and commercial fisher.
The extreme highs and lows in lake levels are the main problems facing cattle producers around the lake. High water at the wrong time translates into lost hay and pasture. Water spilling into lowlands adjacent to the lake does not drain away when the lake level drops. While the cattle producers recognize that they cannot expect good hay along the lake every year, and that occasional, natural flooding is good for the grass, they would like high spring water levels to be

drawn down by late June or early July to allow for haying. A level of 811.6 ft asl in the middle of June makes for an excellent year for cattle producers.

Cattle producers are concerned that the method of calculating lake levels is not accessible to the public. They are also concerned that the Portage Diversion is being operated with no consideration for the impacts on water quality or on farmers around the lake.

3.4 April 9, 2002 – Eddystone

Woods Creek Cottagers Association – Andrew Bobinski, Vice-president

Woods Creek Cottagers Association (about 20 members) contended that the water levels in the northwest portion of the lake are too low from August though to freeze-up. Boats get mired, fisheries are negatively impacted and there are other recreational disbenefits. Prolonged low water hurts fish habitat while increasing cormorant habitat. Cormorants' main diet is fish. They recommend holding the water level two feet higher during the August to freeze-up period than is currently the case.

They have concerns over water quality because of the runoff entering the lake from farmland and the road and highway system in the basin as a whole, and support any efforts to eliminate pollution.

Narrows Lodge/Game and Fish Association – Blair Olafson and Garth Lussier

The Narrows Lodge and Game and Fish Association suggested maintaining stable lake levels around 812.17 ft asl by July 1st, but no higher. Lake levels either higher or lower than this level create boating and boat-docking problems.

They also suggested wind tides at the Narrows are higher now because of the restriction caused by the bridge and causeway.

Manitoba Cattle Producers Association – Bill Finney, MCPA Director and LMRRAC member

The Manitoba Cattle Producers Association described the area around Lake Manitoba as a key cow/calf producing area for the province and the importance of native hay to that industry cannot be overstated. They claimed that excess water in June through the Portage Diversion results in loss of hay and delayed harvest, which affects feed quality. In addition, chronic high water levels have changed the grasses along the lake to less desirable species.

They recommended that the Portage Diversion should not operate after May 31. This would allow water to recede in time for hay harvest. Material and foreign species entering the lake through the Diversion is also a concern for water quality. They suggested the FRWCS should be open for an appropriate length of time to keep water levels at the mean level of 812.17 ft asl, with July and August having the lowest levels.

The Association recommended the provincial government establish a Lake Manitoba Management Committee to monitor and regulate lake levels. The cattle producers should have a representative on the committee. The currently inactive Assiniboine River Management Advisory Board should be reinstated to monitor activities along the entire length of the river in Manitoba. It should also have a cattle producers' representative.

During discussion, Association representatives indicated they could accept a wider range of lake level fluctuation, with shorter high periods and longer low periods, provided the highest level was 812.17 ft asl. In their opinion, the optimum water level is 811.5 ft asl.

Alan Johnson, cattle producer
Poor (lake level) regulation has negatively affected cattle production, fisheries and the environment in general. The Portage Diversion has had a negative impact on water quality. He recommends that 812.17 ft asl should be the highest water level.

Gudjon Sigurdson, cattle producer
High water makes cattle farming difficult, since herds often have to be moved to drier ground. Late hay harvest results in low quality hay. When the land floods, it does not drain naturally. Water diverted through the Portage Diversion into the lake causes problems with ranchers. Natural fluctuations are okay, and high water in the spring is tolerable, but levels need to be lower later in the season. He recommends shutting down the Portage Diversion.

3.5 April 15, 2002 – Amaranth

Dr. Wayne Cowan, Consultant, Lake Manitoba Basin Initiative
In 2000, Dr. Cowan had been contracted by the Lake Manitoba Basin Initiative to assess the body of information relating to the regulation of Lake Manitoba levels. Based on the knowledge he gained during that endeavour, he presented a number of recommendations for actions that could be taken to rectify the ecological and physical damages, which in his opinion, have occurred over the period the lake has been controlled.

Overall he concludes that all groups are willing to "give a little" to help their neighbours and to help restore the lake.

Foremost among his recommended actions is to change the rules of operation for the FRWCS on an experimental basis to more closely emulate natural conditions, but with a smaller degree of variation than experienced in the pre-regulation period. The regime might include a spring water elevation of 813.0 ft asl which would be reduced to no less that 811.5 ft asl by mid-July and held there through the winter. This could have a positive impact on marsh regeneration, beach rebuilding and carp reduction. In addition, he recommended maintaining Lake St. Martin water levels at no less than 800.0 ft asl over winter.

Dr. Cowan recommended operating the Portage Diversion only when necessary and releasing spring flows earlier and more slowly to reduce sediment, debris loads and overtopping of the Diversion dikes into Delta Marsh. Agricultural land drainage channels entering the lake must be planned and designed to reduce sediment loads, he said.

He also suggested a number of investigations, studies and activities that should be undertaken in the interim. For example, the FRWCS and associated channel should be examined to determine whether they actually have the capacity necessary to achieve the desired Lake Manitoba regime while reducing impacts downstream. If not, the structure should be repaired and the channel upgraded. The feasibility of a control structure on the lower reach of Lake St. Martin to allow additional flows to the east during flood years should be investigated. On the south end of Lake Manitoba, the feasibility of a controlled outlet channel (Long Lake Drain) from the lake to the Assiniboine River downstream of Portage la Prairie should be re-evaluated.

He also indicated studies should be initiated to examine the impacts of a new water level regime on lakeside marshes, whether removing barriers and culverts in the beach ridge will help return Delta Marsh to a healthy state, and to determine ways to permanently eradicate hybrid cattail in the marshes.

Long-term actions Dr. Cowan suggested include monitoring seasonal and annual water levels on lakes Manitoba and St. Martin and the factors affecting the resources of the Lake Manitoba system. This information could be used to fine-tune the system on an on-going basis. Water quality monitoring stations should be established at key points upstream in the basin, in the lake and downstream from the FRWCS. Studies of the effects of the trial water regime on fish should be undertaken, as should an examination of the relationships of water levels to muskrat populations and survival. In addition to monitoring waterfowl populations in the marshes, other birds and furbearers should also be added to the program.

Lake Manitoba Fish Enhancement Committee – Terry Ejyolfson, Committee Chair and LMRRAC member

The Lake Manitoba Fish Enhancement Committee pointed out that stable water levels on Lake Manitoba are too constant and affect fish spawning areas and marshlands. They also expressed serious concerns about the effectiveness of the fish ladder at Fairford. They recommended building a new control structure in Lake Manitoba at the entrance to the Fairford River to manage the amount of water entering the river. They also recommended improving the fish ladder in the FRWCS to allow the passage of a wider variety of sizes and species of fish.

3.6 April 17, 2002 – Portage la Prairie

Ducks Unlimited Canada – Don Sexton

Ducks Unlimited pointed out that the historic range of water levels on Lake Manitoba has been between 810.0 to 816.0 ft asl with high and low periods lasting several years. The current regulation has a range around 812.17 with the high and low periods lasting only weeks and sometimes seasonally out of synchronization. This water level stabilization, in combination with carp activities, infilling and dyking, and drainage has caused wetlands quality to decline over the decades. The wetlands have lost both emergent and submergent aquatic plants.

Mr. Sexton suggested Lake Manitoba marshes could be restored by managing them independently of Lake Manitoba with dyking and pumping, but the cost would be monumental. There would be other negatives such as the exclusion of desirable species of fish and restricted human access.

Ducks Unlimited recommends the restoration of water level fluctuations, especially over the long term. A range of 810.0 to 813.0 ft asl could be maintained over an eight to 10 year cycle with highs and lows lasting for one or two years. Seasonally, water levels should follow a more natural mode, higher in spring, lower in summer. Efforts should also be undertaken to exclude carp from the marshes.

Ducks Unlimited Canada – Dr. Henry Murkin

There is a need for more scientific information to guide future management. A return to natural fluctuations is important to restore the marshes. Dry periods should be a minimum of one year, highs a minimum of two years. Whitetop hay, for example has a critical need for annual water level fluctuation.

All "stewards", or interest groups must be involved in a long-term strategy.

Institute of Wetland and Waterfowl Research (Ducks Unlimited) – Dr. Dale Wrubleski

Mr. Wrubleski discussed some of the problems facing the fisheries in Delta Marsh. He explained that while prairie marshes are not generally considered important fish habitat, Delta Marsh is different because of its association with Lake Manitoba. Lake Manitoba fish use the marsh for a variety of activities, such as feeding during the ice-free period, returning to the lake in the winter.

The Delta Marsh Monitoring and Assessment Project in 1997 showed a decline in the quality of fish habitat in the marsh. Carp, bullheads and other introduced species have become dominant in the marsh. Water quality has deteriorated and emergent vegetation has been lost to strong winds and wave action.

The Institute recommends fluctuating water levels on a greater scale – perhaps by about three feet – and for a longer term to create wet and dry cycles in the marsh. This would be done using a new control structure at Fairford. The Institute also recommends increasing the harvest and exploitation of the abundant carp populations in the marsh (under-utilized resource) rather than excluding them from the marshes by using screens, thereby excluding other important fish species in the process

Dr. Rick Baydack, University of Manitoba Professor and Interested citizen

Dr. Baydack indicated that the stabilized level approach to water level management has caused damage and the Lake Manitoba ecosystem needs to experience a greater range of water levels while its effects on ecology, economics and downstream areas are monitored. He recommended fluctuating water levels on a scale closer to historical/natural levels. A basin management strategy should be implemented that involves admitting uncertainty exists, setting consensus-based objectives so as to learn by doing, monitoring outcomes to enhance future decisions and continuing the approach over the long term.

Lo-Duck Lodge – Tim and Ian Forrest

The operators of Lo-Duck Lodge expressed concern that Delta Marsh is becoming good habitat for only carp and phragmites. Fisheries are declining due to carp and high water effects on spawning grounds. Shoreline erosion is washing away beaches and shoreline trees. They recommend a "natural ecosystem" where water levels fluctuate on a greater scale, but not keeping water levels consistently high.

Ross Gage – Representing "Tin Town"(Delta Marsh)

Several duck species have declined in population in Delta Marsh since 1965 – notably lesser scaup and canvasbacks. Fewer aquatic plants in the marsh means less food for waterfowl. He recommended creating more natural wet and dry cycles with greater fluctuation of water levels to improve the health of the marshes.

Delta Waterfowl Foundation – Jonathan Scarth

Mr. Scarth pointed out that farmers, ranchers and cottage owners have suffered loss of property and income as a result of stable water levels and declines in water quality. Attempts to achieve local political consensus on plans to separate the management of the Delta Marsh from the water levels on Lake Manitoba have failed. Stabilized water levels have been a mortal blow to the health of the marshes around Lake Manitoba, causing problems like hybrid cattail and carp.

On behalf of the Foundation, Scarth suggested the need for the development of a large area sustainable development plan for the Lake Manitoba Basin. The province should identify and sanction a lead agency to develop this plan. The agency should implement an adaptive, variable water management protocol within the tolerance of the community and sufficient to allow measurement of the effects on the peripheral marshes.

The protocol should allow for seasonal variation, and on a longer term, periodic bursts of high (813.0 ft asl) and low (811.0 or lower) water level intervals over a ten-year cycle.

Delta Beach Association – Ken Holland and Kelly Giffin

The Association is not opposed to the use of the Portage Diversion, but is opposed to its negative effects on the water quality of Lake Manitoba. In addition, high water has caused shoreline erosion on Delta Beach.

The Association recommends repairing the Portage Diversion and developing a better clean-up process after the Diversion has been in use. They also recommend lowering water levels on Lake Manitoba to a range of 810.6 to 812.0 ft asl to encourage beach and shoreline rebuilding, but the level should not be maintained at 812.0. Ideally, late July levels should be about 810 ft asl.

Delta Agricultural Conservation Co-op – Ian Wishart

The Delta Agricultural Conservation Co-op feels that water levels have been kept at the high end of the target range far too often, resulting in negative impacts on the shoreline, particularly in the south basin, which is contributing to severe shoreline erosion problems. High water levels have also impacted hay and pastureland negatively and adversely affected marshes. Stable water levels have negatively impacted Delta Marsh. The Co-op recommends allowing lake levels to reach both the lowest and highest levels in range on a more frequent basis.

The Co-op feels the Portage Diversion inflow is not proportionate to outflow at the FRWCS and that added outflow is needed, perhaps through the Long Lake Drain in the south basin.

4.0 Regulation of Lake Manitoba

4.1 Postglacial Water Level Change on Lake Manitoba

Measurement of Lake Manitoba water levels began formally around 1900 although records from this period have been lost. Therefore, trends in lake water level in the 19th century and earlier can only be inferred directly from historical records and reconstructions based on lake sediments.

A reconstruction of post-glacial water level changes in Lake Manitoba was made in the late 1970s based on sediment cores collected at 51 sites around the south basin.[12] The approach is based on the fact that living and non-living matter settles gradually to the lake bottom over time so layers in the vertical column represent successively older deposits relative to the core surface. If the rate of sediment deposition can be determined, the age of each layer can be estimated, then analysis of materials in specific layers can be used to infer environmental conditions in the lake at the time that the layer was deposited.

These reconstructions indicate that Lake Manitoba water levels fluctuated dramatically over the past 9,500 years (Figure 4.1: Post-glacial History), much more so than its recorded variation within the last century. From 9,500 to about 5,000 years ago, the central prairies of Canada and the USA were warmer and drier than at present. Many shallow lakes throughout the region became dry. Lake Manitoba probably retained shallow water in the center of its south basin except during periods of severe drought. However, uplifting of the outlet to the Fairford River caused by rebounding of the land surface following the northward retreat of the glaciers restricted outflow, allowing the lake to expand once again. Near-shore areas of the lake dried out and became covered by trees and other terrestrial plants. This condition is inferred by the presence of four discrete soil-like zones in the core layers from this time, implying that the lakebed dried and developed into terrestrial soil at least four times.[13] The uppermost of these zones at sites about 15 km offshore occur at an elevation of about 785 feet above sea level (determined by core sampling), indicating the lake bed at that location was dry at the time. This was probably the lowest level of Lake Manitoba, occurring between 5,500 and 4,500 years ago, when the entire south basin may have been dry. This period of low water ended when the Assiniboine River began to flow northward into the lake.

The lake was initially salty as a result of evaporation over thousands of years, but, with input from the Assiniboine River, the water gradually became fresher. As the lake level rose over a few hundred years, water again began to spill over the Fairford River outlet and flow into Lake Winnipeg. By 3,500 years ago, water levels in Lake Manitoba were similar to today. Sediments deposited at the mouth of the Assiniboine River, near the present site of Delta, formed a peninsula extending several kilometres into the lake. Erosion of this peninsula by counter-clockwise lake currents formed an eastward-extending barrier of sand that, by 2,500 years ago, had completely isolated the southernmost end of the lake, forming Delta Marsh.[14] Since then, lake boundaries have remained roughly the same.

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[12] Last, W.M. 1980. Sedimentology and postglacial history of Lake Manitoba. PhD dissertation, University of Manitoba, 687pp.

[13] Teller, J.T. and Last, W.M. 1982. Pedogenic zones in postglacial sediment of Lake Manitoba, Canada. *Earth Surface Processes and Landforms*, volume 7, pp. 367-379.

[14] Teller, J.T. and Last, W.M. 1981 Late Quaternary history of Lake Manitoba, Canada. *Quaternary Research*, volume 16, pp. 97-116.

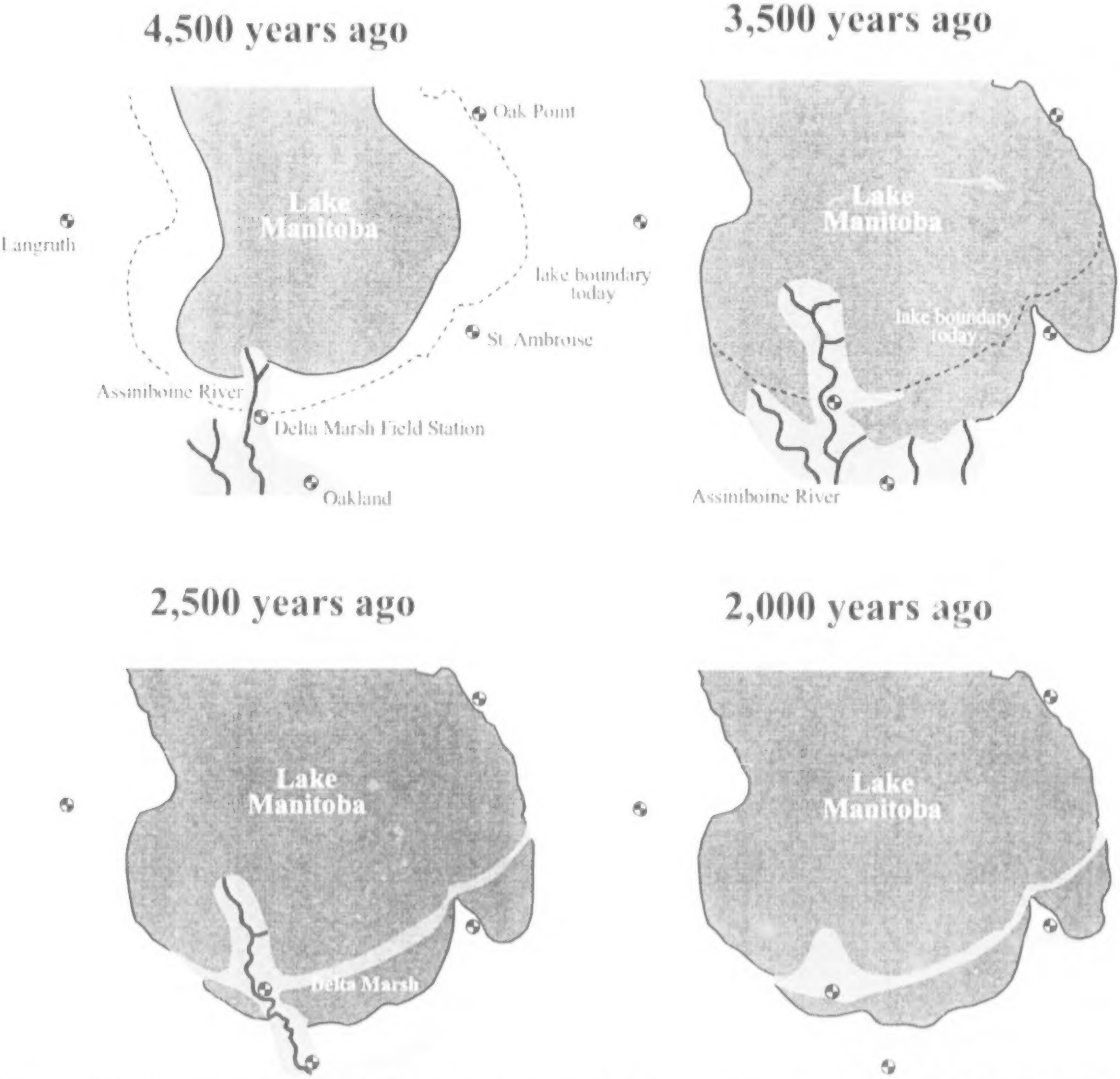
4,500 years ago
Oak Point
Lake Manitoba
Langruth
lake boundary today
St. Ambroise
Assiniboine River
Delta Marsh Field Station
Oakland
3,500 years ago
Lake Manitoba
lake boundary today
Assiniboine River
2,500 years ago
Lake Manitoba
Delta Marsh
2,000 years ago
Lake Manitoba

Figure 4.1. Reconstruction of changes in Lake Manitoba between 4,500 and 2,000 years ago, based on analysis of lake sediment from 51 sites in the south basin[15]

Sometime between 2,500 and 2,000 years ago, the Assiniboine River flow was redirected eastward to its confluence with the Red River at the present site of Winnipeg. Without new supplies of sediment, the old Assiniboine River peninsula eroded to an underwater relict. Lake levels have been relatively stable for the past 2,000 years.

Records of water level change on Lake Manitoba during the 19th century are sketchy, based on a few geological survey reports of the time. These are supplemented by reminiscences of severe

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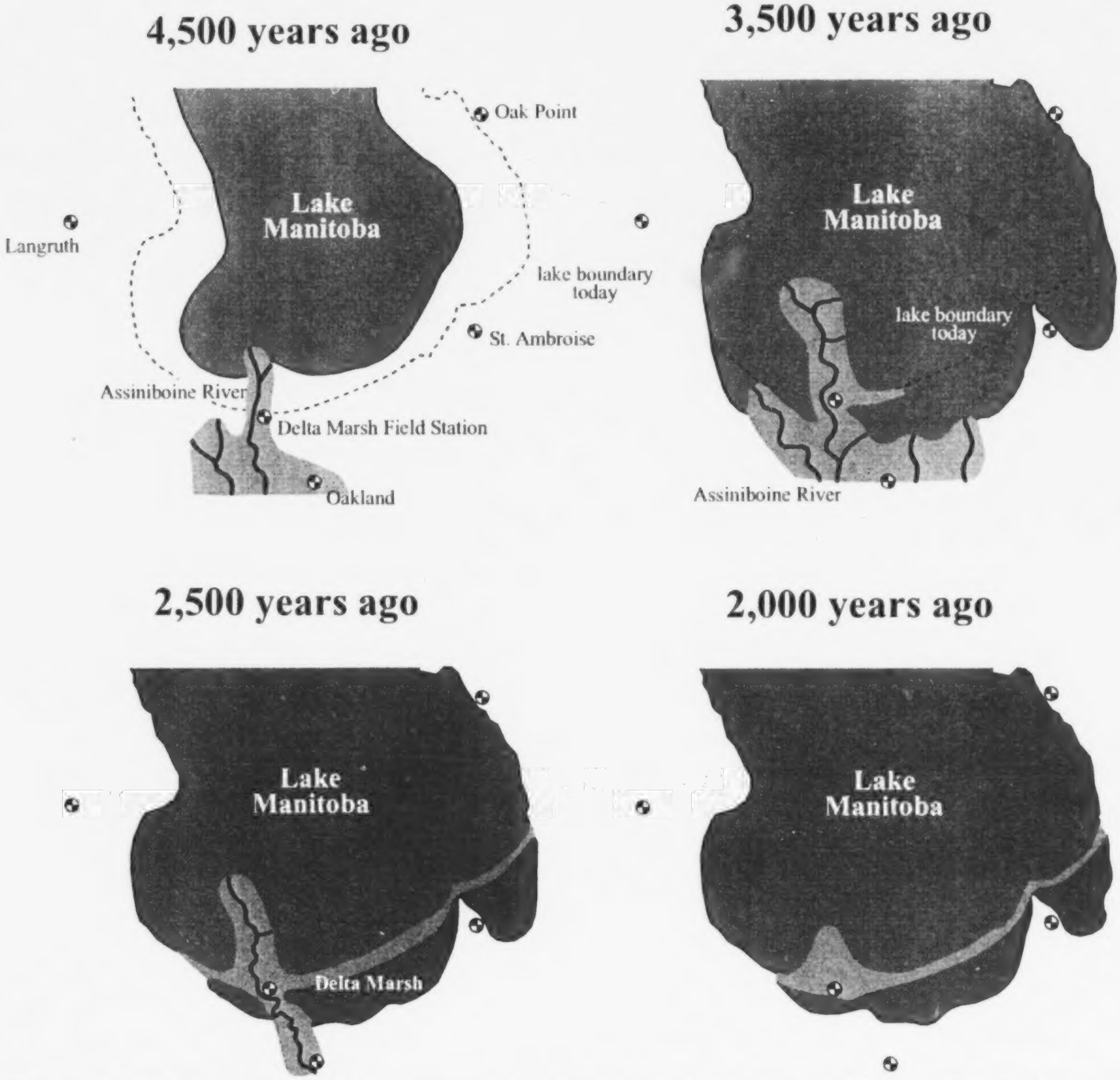
[15] Teller, J. T. and Last, W. M. 1981. Late Quaternary history of Lake Manitoba, Canada. *Quaternary Research*, volume 16, pages 97-116


4,500 years ago
Lake Manitoba
Oak Point
Langruth
lake boundary today
St. Ambroise
Assiniboine River
Delta Marsh Field Station
Oakland
3,500 years ago
Lake Manitoba
lake boundary today
Assiniboine River
2,500 years ago
Lake Manitoba
Delta Marsh
2,000 years ago
Lake Manitoba

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Records of water level change on Lake Manitoba during the 19th century are sketchy, based on a few geological survey reports of the time. These are supplemented by reminiscences of severe climatic events, including droughts and floods, preserved in historical archives and personal memoirs. Years of unusually high water include 1826, 1852, 1874-5, 1881-2, 1897, 1902 and 1908, while 1888-9 and 1901 were periods of low water.[16]

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[15] Teller, J. T. and Last, W. M. 1981. Late Quaternary history of Lake Manitoba, Canada. *Quaternary Research*, volume 16, pages 97-116

Lake water levels were probably higher in 1881 and 1882 than at any time during the past two centuries. In the fall of 1881, the Assiniboine River flooded across the flat countryside, washing out railway bridges, inundating farms and following its old abandoned channels down the 40-foot slope to Lake Manitoba. Inhabitants of the thriving port town of Totogan on the Whitemud River were forced to higher ground and eventually the site was abandoned altogether. The high water was not confined solely to the Assiniboine River, Lake Manitoba and its outflow were also high. The Fairford River was topping its banks, with discharge being estimated at just under 15,000 cfs.[17]

The flood resumed following the spring snowmelt when, for 12 days in May 1882, the Assiniboine River again flowed across country to the lake.[18] Its level was already so high that, with the added river floodwater, flow commenced out the southeastern corner of Lake Manitoba, something it had probably not done for hundreds, if not thousands of years, discharging into the Assiniboine River some 32 kilometres east of Portage La Prairie.

Given the topography of the surrounding landscape, such southward outflow could only occur when the lake level exceeded 817.0 ft asl[19], probably the highest level of Lake Manitoba in the 19th and 20th centuries. Periodic flooding of the land surrounding Lake Manitoba would recur in the early 20th century.

4.1.1 The Record of Water Level Measurements on Lake Manitoba

The necessity of shipping goods on shallow Lake Manitoba drove the need for accurate water level measurements. And the Whitemud River, being the southern transfer point between the lake steamboats and the railways, was the logical place for taking them.

Fish and lumber merchant Peter McArthur had been taking readings since his arrival in the early 1880s[20] and these measurements were carried on into the early 20th century by employees of the Manitoba Gypsum Company at its ports on the Whitemud and at Gypsumville[21]. In 1909, the federal Department of Public Works provided two gauges to the Manitoba Gypsum Company for installation at its ports at Totogan (on the Whitemud River) and Gypsumville, to replace earlier ones which had been deployed too high to measure the low water levels occurring in 1907. Regrettably, data from these early stations could not be located in federal government archives.

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[16] National Archives of Canada, Winnipeg office. Department of Public Works. Accession W84-85/493 Box 20 Lake Manitoba. Internal memo, dated 29 April 1914, by A.J. Stevens to Chief Engineer.

[17] National Archives of Canada, Ottawa. Arthur Meighen Fonds. Microfilm reel C-3453, pages 54339 – 54380. Department of the Interior, Dominion Water Power Branch. Dunn, T. H., Report on the lowering of Lake Manitoba, dated 7 July 1915.

[18] *Manitoba Free Press*, 8 May 1882, page 6

[19] Last, W.M 1984. Modern sedimentology and hydrology of Lake Manitoba, Canada. *Environmental Geology*, volume 5, pp. 177-190.

[20] Manitoba Legislative Library, History Scrapbook M1, p. 72.

[21] National Archives of Canada, Winnipeg office. Department of Public Works. Accession W84-85/493, Box 50 "Whitemud and Totogan", 1893 to 1934. Correspondence from District Engineer, Winnipeg, to William Martin of Manitoba Gypsum Company, 28 July 1909.

The available water level database for Lake Manitoba begins in 1913 with the establishment of a gauging station at Meadow Portage, followed by another at Delta in 1914. These stations were subject to wind setup. Severe wind events at Delta, for example, are known to raise water levels a metre or more within a few hours. The station at Steep Rock, by virtue of its location being less susceptible to wind effects, has replaced those stations, which were discontinued in the late 1960s. Steep Rock is considered to represent the wind-eliminated level of the lake. It is the oldest operating station on the lake (Table 4.1), and provides all data for lake modeling by the provincial government.

Table 4.1. Periods of record for daily water level gauging stations on Lake Manitoba. (Table prepared by the Committee with data provided by R. Bowering, Manitoba Water Branch.)

Station	Years of record	Start Date	Stop Date	Minimum (feet ASL)	Maximum (feet ASL)
Delta	55.3	12 July 1914	12 November 1969	809.27	816.32
Meadow Portage	55.3	27 August 1913	4 December 1968	810.07	816.02
The Narrows	38.6	13 May 1958	31 December 1996	810.20	813.54
Steeprock	79.3	22 August 1923	-	809.92	816.25
Tout Aides	25.3	8 January 1969	31 May 1994	810.34	813.37
Westbourne	38.1	27 October 1964	-	810.33	814.72

4.2 A Summary of Previous Reports

4.2.1 Lakes Winnipeg and Manitoba Board – 1958

Following the high lake levels of the mid 1950s, the Lakes Winnipeg and Manitoba Board was established in July, 1956 as a joint Government of Canada - Government of Manitoba board. Its purpose was to "*plan, supervise and carry out a survey of Lakes Winnipeg and Manitoba and the resources of water within Manitoba flowing into and from those lakes and shall determine and report what further developments and controls of these water resources in its judgment would appear to be physically practicable with particular reference to (a) flood control and (b) hydro-electric power.*"

In their report, the Board noted under "Purpose of Study" that, "*In their present uncontrolled state, the monthly mean levels of Lakes Winnipeg and Manitoba have fluctuated through a range of seven and five* (feet) *respectively. Extremely low stages cause inconvenience to navigation, beach resorts and wildlife interests. As a result, there has been strong local demand for control of the levels of these lakes, preferably close to their mean stages.*" By resolution, the Board interpreted the Terms of Reference such that in pursuing its studies "*any upstream or downstream problems created by regulation be considered only to the extent that they may have a significant bearing on the regulation of the lakes.*"

In 1958, the Board released its final report.[22] Appendix 5 to that report,[23] which deals specifically with Lake Manitoba, describes the purpose as "*....investigate such measures as might alleviate flooding of the lands bordering Lake Manitoba*". This study was the landmark in the efforts to manage the levels on Lake Manitoba because it led to the construction of the Fairford River Water Control Structure (FRWCS) in 1961.

At the time, records indicated that mean monthly water levels recorded at Delta varied from a low of 810.3 feet above sea level (ft asl) in 1942 to a high of 815.8 ft asl in 1955. (These were recorded using the original datum.) During the low water period, cottagers complained of unattractive beaches and farmers complained that dried-up marshlands allowed the growth and spread of weeds to nearby farmland resulting in a loss of hay production. However, during high water, large tracts of land were flooded, threatening cottages and flooding hayland. Fishermen and trappers complained about the loss of production.

In addition to local interest at the time, several other factors were driving the investigation of regulating Manitoba's three major lakes. Nelson River hydroelectric power development was on the horizon and augmentation of flows on the Nelson was being considered by regulating the lakes. The development of the Dauphin River for hydroelectric power generation was also being examined.

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[22] Lakes Winnipeg and Manitoba Board, 1958. Report on Measures for the Control of the Waters of Lakes Winnipeg and Manitoba, Province of Manitoba.

[23] Lakes Winnipeg and Manitoba Board, 1958. Report on Measures for the Control of the Waters of Lakes Winnipeg and Manitoba, Province of Manitoba. Supplementary Volume II, Appendix 5, Lake Manitoba Regulation for Flood Control.

Diverting floodwaters from the Assiniboine River into Lake Manitoba was being considered as one component in an overall flood control plan for Winnipeg. Also, a water supply channel from Lake Manitoba to the Assiniboine River downstream of Portage (Long Lake Drain) was being looked at as one possible solution to enhancing low flows on the Assiniboine River during dry periods.

In an effort to determine the most feasible method of reducing the detrimental effects of high and low stages on farmland and other private property around the lake, three possible solutions were examined. First, the feasibility of purchasing flood-prone agricultural land and beach property, or otherwise acquiring flood easements, was examined. The conclusion was that this action would involve considerable expense without having solved the flooding problem.

Secondly, the construction of dikes to prevent flooding was considered. The report noted that protecting all of the low-lying lands around the lake from flooding through the use of dikes was impractical. So, the study focused on an estimated 17,000 hectares located in two areas – Delta Beach and a portion of the RM of Lakeview.

A preliminary analysis revealed the costs far exceeded the benefits. In addition, it was determined that a dike failure would make the flood situation worse and land drainage into the lake after a heavy rain would be impeded due to the presence of the dikes.

4.2.1.1 The regulation of Lake Manitoba water levels within narrow limits

The study turned its focus to managing the water levels on the lake. The range chosen for lake level management was from 811.0 ft asl to 813.0 ft asl because, according to the report, local residents indicated a preference for managing the levels at 811.5 ft asl. Also, the Board concluded that *".... levels between these two elevations should have little detrimental effect on any interests...".* An assessment of the potential impacts on agriculture and other resources does not appear in the report.

Two methods were examined – control Lake Winnipegosis and improve the outlet of Lake Manitoba.

Control Lake Winnipegosis

The concept was to use Lake Winnipegosis as a regulating reservoir, allowing the proper amount of water to enter Lake Manitoba to manage it within the range of 811.0 to 813.0 ft asl. It was determined that to accomplish this, Lake Winnipegosis would have to be allowed to rise as high as 837.0 ft asl, and that an outlet channel capable of handling 5,300 cfs would be required. The highest Lake Winnipegosis had risen in the 40 years prior to the study was to elevation 833.7 ft asl in 1954 and 1955.

In the end, it was determined that this option was too costly because of the need for diking the south end of Lake Winnipegosis to contain water at the maximum elevation of 837 ft asl, and the construction of a rather large diversion channel and control structure.

Channel improvement and control structure at the outlet of Lake Manitoba
This option was chosen as the most cost-effective method of managing water levels on Lake Manitoba and was eventually employed. The report claims that had the system been in place, it would have been possible to keep the lake within the 811.0-813.0 ft asl range during the entire period of record (1914-1956). It further adds that if even a flood control channel from the Assiniboine River (being considered at the time) and a water supply channel from the lake to the Assiniboine River downstream of Portage (also being examined) had been in operation, lake levels would only have exceeded the 813.0 ft asl upper limit during three months of the entire 42 years prior, and then only slightly.

Construction of the FRWCS commenced in 1960 and the new structure, which included a highway across the top, was completed in the fall of 1961. Operating rules were put in place to control the lake between the levels of 811.0 ft. asl – 813.0 ft. asl with a target level of 812.5 ft. asl. Subsequently, these levels were reduced by 0.33 ft. as a result of a survey datum adjustment.

Under these operating rules, flow through the structure was adjusted on a regular basis to bring the lake level to the target level as quickly as possible. These rules served to maintain a relatively stable level on Lake Manitoba. However, due to the large variation in outflows now possible, the variability in water levels was transferred to Lake Pineimuta and Lake St. Martin, resulting in high water and flood damage in some years and extremely low water levels in other years. While the high water levels are damaging to property, the low water levels are damaging to the commercial fishery on Lake St. Martin and to recreational interests.

Using data from the high water period of January 1952 to September 1956, the effects on Lake St. Martin of operating the FRWCS according to the rule described above were calculated. The Board concluded that the high stages on Lake St. Martin would be decreased somewhat. However, it was also determined that the periods during which there is no flow on the Fairford River were lengthened considerably, but that *"... a complete stoppage of flow could be avoided by a slight adjustment to the Lake Manitoba operating rule."*

The report focused almost entirely on managing water levels for flood control along the shores of Lake Manitoba, and presumably, with a secondary agenda of examining the lakes for hydro development. The study was only concerned with impacts on other resources and resource users if those impacts affected the regulation of Lake Manitoba.

4.2.2 Manitoba Water Commission, 1973
From the beginning of operation of the FRWCS, complaints and concerns were expressed by residents of the region about the regulation of the lake within the range 811.0 to 813.0 ft asl.

In December of 1968, the Minister of Natural Resources convened the Manitoba Water Commission to identify the most acceptable and practical range within which the levels of Lake Manitoba might be controlled. Additionally, the Commission was asked to determine *"whether or not it is practical and desirable to maintain the lake during the different seasons of the year at certain stated levels and if it be found to be practical and desirable, the recommended levels for the different seasons of the year."* In 1972, after a change in administration and a period of re-organization, the new Minister of the restructured Department of Mines, Resources and Environmental Management reiterated these instructions to the Commission.

In December 1973, the Commission released its report[24]. The major focus was the impact of the operation of the FRWCS downstream on the agricultural, wildlife and fisheries resources on Pineimuta Lake and Lake St. Martin and environs. The Commission was also asked to consider the desire of ranchers around Lake Manitoba that the lake be regulated to a target level of 811.67 ft asl, one-half foot lower than the 812.17 ft asl target level. (Figures relate to the revised datum.)

The study concluded that lowering the target level would reduce the social and economic values of the recreational, wildlife and fisheries resources on and around the lake.

The Department of Mines, Resources and Environmental Management conducted a preliminary study of the impact of a six-inch drop in the mean lake level on beaches along the lake. It determined that the resultant impact would be rather small, although the quality of swimming and boating activities would be reduced at all locations. Conversely, it also pointed out that at some beaches, minor reduction in erosion would occur and a moderate improvement in bathing qualities would result. (Swimming and bathing were identified as two distinct activities.) There was no specific mention of the wishes of cottage owners along the lake in the Commission's report. However, a presentation made to the Commission by a representative of the Delta Beach Association indicated that lake levels should not be lowered.

The Commission stated that the quality of sport fishing would be reduced if the minimum level of the lake was reduced. It also pointed out that biologists of the time indicated that reducing the mean level of the lake would have a deleterious influence on the lakeshore marshes. The negative impact of fluctuating water levels on the fisheries and waterfowl and furbearer habitat downstream of the FRWCS was also noted.

In the end, the Commission concluded that the only resource use to benefit from lower lake levels would be agriculture where additional native hay land would be made available.

They recognized that if Lake Manitoba was to be controlled within the prescribed range it would not possible to decrease the variance of water levels on Pineimuta Lake and Lake St. Martin without altering the regime on Lake Manitoba to the serious disadvantage of the resources associated with this lake. However, overall improvement to the regimes of Pineimuta Lake and Lake St. Martin could become feasible with installation of a control structure and ancillary outlet improvements at Pineimuta Lake and/or Lake St. Martin.

The study concluded that Lake Manitoba should continue to be regulated to target elevation 812.17 ft asl, with the same range of 810.87 – 812.87 ft asl but recommended that "*… in no case should the outflow from Lake Manitoba be less than 50 cfs.*".

The study recommended that agriculture, wildlife, fisheries and recreational resources associated with Lake Manitoba be optimized with respect to the existing mode of regulation. It also suggested that studies should be undertaken to better understand the dynamics and sensitivity of these resources to Lake Manitoba water level variations.

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[24] Manitoba Water Commission, 1973. Lake Manitoba Regulation, Volumes I and II.

It further recommended further study of agricultural, wildlife, fisheries and recreational resources associated with Pineimuta Lake, Lake St. Martin and Dauphin River be undertaken in order to optimize the collective value of these resources and that in this respect, the benefit from a control structure and ancillary improvements at the outlet of Pineimuta Lake and/or Lake St. Martin be evaluated.

4.2.3 Manitoba Water Commission, 1978

Concerns about the wide fluctuations of water levels on Pineimuta Lake and Lakes St. Martin continued and numerous complaints were directed to the Department of Mines, Resources and Environmental Management and the Province in general. The Province considered it advisable to proceed with a study to determine the best way to improve the water level regime of the two lakes.

In 1977, the Manitoba Water Commission was instructed to *"... undertake the study taking into consideration all the resource uses in the area and the concerns and problems which may be identified by the residents and other interests... "*.

A variety of schemes were examined. The first was that the flows through the FRWCS would be altered to prevent sudden water level changes downstream. The others – nine in all – involved construction of various combinations of dikes, diversions, control structures and channel improvements to control flows and lake levels downstream from Fairford. Preliminary benefit/cost analyses were carried out on each of these proposals.

While all of the options considered would have had a beneficial effect on water levels in Pineimuta Lake and Lake St. Martin, it was determined that the costs of implementing any of these schemes would out-weigh the benefits accrued. For example, the Commission expressed the opinion that while further agricultural use of flood prone lands would occur if the flooding was controlled, the level of productivity would not be improved substantially. Some benefits to the fishery, wildlife and furbearers would be realized. But, it was assumed that the economic benefits to these resources would not be enough to justify the expenditure on water control measures.

As a result, the Commission in its 1978 report[25] recommended the following:

- *"No construction of structures downstream from the Fairford Dam takes place at this time (1978) as the additional benefits accruing as a result of various resource uses, although not easily quantified, appear to be less than the cost of even the least expensive construction proposal;*
- *Discussions should take place with Ducks Unlimited in order that some arrangement may be agreed upon to implement a project to compartmentalize Pineimuta Lake in order to optimize the productivity of that lake;*
- *Another examination be made of the method in which the Fairford Dam is operated to determine if marginal adjustments may be made to prevent large sudden changes in water levels occurring below the Fairford Dam at critical periods associated with the various resources and their uses; and*

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[25] Manitoba Water Commission, 1978. Lake St. Martin and Pineimuta Lake Regulation.

- *As a result of the construction and operation of the Fairford Dam, some disbenefits occur to the area around Lake St. Martin during periods of low water flow. The Commission feels that it is not unreasonable, therefore, that some consideration might be given to the mitigation of the financial problems of the users affected during this low flow period".*

Although not phrased as a recommendation, the Commission suggested that there should be an evaluation of a plan in which the entire watershed of Lake Winnipegosis, Lake Manitoba, Pineimuta Lake and Lake St. Martin leading into Lake Winnipeg be considered as one economic unit. The Commission cited an example of possibly redirecting water from Lake Winnipegosis into Cedar Lake, which in turn could help feed the hydro-electric generators at Grand Rapids. In that manner, the benefits of producing hydro power could be used to offset the costs while providing greater control to water levels on Lake Manitoba, and amelioration of problems downstream.

To the knowledge of the Lake Manitoba Regulation Review Advisory Committee, no further studies were conducted by the Province regarding Lake Manitoba regulation and its impacts until the current study was commissioned in 2001.

4.3 Lake Manitoba Regulation

4.3.1 Water Budget

Over the long term, nearly 80 per cent of all overland inflow of water into Lake Manitoba comes from Lake Winnipegosis into the north basin of Lake Manitoba through the Waterhen River, and an even higher percentage if the contribution of the Portage Diversion is not considered. (data supplied by Alf Warkentin, Manitoba Water Branch). Since 1972, annual inflow from the Waterhen has averaged about 1.9 million acre-feet (ac-ft) ranging from a low of 857,186 ac-ft in 1976 to a high of 3.24 million ac-ft in 1997. (Table 4.2) There is no control on the outflow from Lake Winnipegosis into Lake Manitoba.

Table 4.2: Lake Manitoba Water Inflows: 1972 – 2001
(Source: Alf Warkentin, Manitoba Water Branch)

Source	Average Annual Contribution in acre-feet	Percentage of Overland Flow	Percentage of Total Contribution	Highest Contribution in acre-feet (Year)	Lowest Contribution in acre-feet (Year)
Waterhen River	1,903,979	78.5%	45.0%	3,241,959 (1997)	857,186 (1981)
Whitemud River	149,077	6.0%	3.5%	500,000 (2001)	29,300 (1989)
Local Flows	108,440	4.5%	2.5%	630,000 (2001)	18,500 (1989)
Portage Diversion*	246,774	11.0%	6.0%	1,420,460 (1976)	-
Precipitation	1,815,121	0.0%	43.0%	2,581,407 (1975)	1,571,087 (1972)
Totals	4,223,391	100.0%	100.0%		

* Calculated over the entire 33-year life of the Diversion.

Table 4.3: Lake Manitoba Water Outflows: 1972 – 2001
(Source: Alf Warkentin, Manitoba Water Branch)

Source	Average Annual Outflow	Percentage of Total Outflow	Highest Outflow (Year)	Lowest Outflow (Year)
Fairford River	2,029,198	50.2%	4,377,875 (1974)	424,973 (1982)
Evaporation	2,016,244	49.8%	2,350,857 (1976)	1,806,607 (1998)
Totals	4,045,442	100.0%		

Note: The difference between the total inflow and outflow figures averaged over the period 1972-2001is likely due to uncertainties in factors such as precipitation, evaporation and inflows used to calculate the annual totals. Ideally, these figures would be the same over a long period of time assuming that the lake levels at the beginning and the end of the period are similar. – Alf Warkentin.

The only significant overland flow into the south basin is the Whitemud River which provides about six per cent of the natural inflow. Local inflows from smaller streams and drainage channels, and input from groundwater aquifers around the lake provide the remainder. Another significant contributor is the Portage Diversion which has been operated in 23 years since its construction in 1970. In its largest year, 1976, the Diversion added 1.4 million ac-ft to the lake.

Annual precipitation, on average, provides roughly 1.8 million ac-ft of water to Lake Manitoba, or nearly as much as the inflow from the Waterhen River. Thus it is apparent that in years of low inflow and precipitation, the total input (overland flow plus precipitation) may be less than evaporation from the lake plus outflows through the Fairford River. (Table 4.3)

A minimum outflow from the lake down the Fairford River is required to maintain a reasonable water level on Lake St. Martin and flow in the Dauphin River in order to protect the fisheries in these waters. Flow and water depth should be sufficient to permit the fall whitefish spawning run and to prevent fish from dying due to oxygen depletion over the winter. In 1981, the Fisheries Branch requested that flows through the FRWCS be maintained within a range of 1000 – 2000 cfs during the September 1 – October 15 period, and at a minimum of 1000 cfs from October 15 to June 1.[26] The Branch indicated that flows less than 1000 cfs during these periods impact negatively on the fishery. However, these flows cannot always be maintained and often the flows are reduced to 500 cfs or less.

In low water years such as 2002, it is difficult, if not impossible to maintain a lake level on Lake Manitoba acceptable to all interests.

4.3.2 Lake Manitoba – Fairford River Water Control Structure (FRWCS)

The history of water level management of Lake Manitoba for the period from 1898 to 1961 can be summarized as consisting of responses to immediate, dramatic water level events. In the late 1890s and again in the early 1960s, following periods of extreme high water, work was carried out at the Fairford outlet to increase outflow, thereby allowing the lake level to be lowered. Work in 1933 in contrast, was done to restrict the flow and to maintain water in the lake following several years of low water conditions.

The hardship among settlers displaced by catastrophic flooding around the lake in the early 1880s lead to a call for the federal government, which had jurisdiction over Lake Manitoba at the time, to do something to control the lake. This lead to excavation of a new channel 200 ft wide, 1,300 ft long and five feet deep at the outlet of the lake, with the water in the channel expected to be 3.5 ft deep during normal conditions.

The next major phase of construction on the Fairford River was instigated to increase water levels following successive dry years in the late 1920s and early 1930s. In December 1933, the provincial government (which had assumed jurisdiction over Lake Manitoba in 1930) announced the completion of a concrete control dam and timber bridge across the Fairford River immediately downstream of the 1899-1901 channel at a total cost of $11,522. The major beneficiaries of the works were thought to be commercial fishers, duck hunters and muskrat trappers who hoped it would restore the drought-stricken marshes around the lake. This structure remained in place until construction of the FRWCS.

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[26] Memo from Worth Hayden, Director of Fisheries to T.E. Weber, Director of the Water Resources Branch, August 6, 1981. Memo from Worth Hayden, Director of Fisheries to J.D. McNairney, Deputy Minister of Natural Resources, September 14, 1981.

Construction of the FRWCS and associated highway bridge commenced in 1960 and was completed in 1961. It was constructed in response to a recommendation of the 1958 Lakes Winnipeg and Manitoba Study Board following a period of excessively high water on Lake Manitoba when the lake reached a level of 816.25 ft asl at Steep Rock. As a result of channel improvements put into place at the time of construction, the structure could prevent both excessively high and low levels from occurring. It was constructed to maintain the lake in the range of 811.0 ft asl to 813.0 ft asl (1960s datum). The structure replaced a dam built in 1934 designed to control low water levels, but which did not have the capacity to control high water levels since no channel improvements had been put in place.

To the knowledge of the Lake Manitoba Regulation Review Advisory Committee, no environmental impact study was conducted prior to the construction of the Fairford River Water Control Structure. It should be noted that such an investigation was not required under Provincial legislation or regulations at the time.

The FRWCS is 73 metres long and consists of eleven 5.9 metre-long bays. The discharge is regulated by removing or replacing stop logs in one or more of the bays. During construction, two concrete weirs were incorporated in one of the bays for fish passage.

The structure began showing sign of distress as early as 1973 when the southeast wing wall required supplementary anchorage to stabilize the wall and eliminate ongoing movement. The structure has been monitored on a regular basis since that time due to the accelerated deterioration of several components, primarily the bridge deck panels, abutments and the wing-walls which have continued to move despite attempts at stabilization. A 1997 report recommended major rehabilitation of the abutments and wing walls as well as rehabilitation, widening and strengthening of the deck and a reconfiguration of the stop-log handling facilities. It is anticipated that this strengthening and rehabilitation will be undertaken in the 2003/2004 fiscal year.

A number of presenters expressed concern regarding the condition of the structure and whether adequate flow could be achieved during periods of extremely high water. Manitoba Conservation's Water Branch advised the Committee that despite the condition of the structure, all of the stop logs could be removed if necessary.

The initial operating rules for the structure were established by the Lakes Winnipeg and Manitoba Board at the time of construction and were simply designed to achieve a target level of 812.67 ft asl as quickly as possible and to maintain that level. Subsequently, in 1973, the Manitoba Water Commission revised the operating rules to establish a minimum outflow of 50 cfs from Lake Manitoba.

While no formal change has been made to the FRWCS operating rules since that time, in recent years the Water Branch has been operating the dam such that the target water level on the lake is achieved over a longer period, thus resulting in less fluctuation in downstream water levels. In addition, they have been operating to a lower water level target in the fall in order to reduce the risk of erosion at the south end of the lake while endeavouring to maintain a minimum flow of 500 cfs in the Fairford River to mitigate negative impacts on the downstream fishery.

As shown in Table 4.4, the maximum recorded daily water level on Lake Manitoba at Steep Rock prior to 1960 was 816.25 ft asl, while the minimum recorded daily water level was 809.92 ft asl. For the period 1960-99 the maximum daily water level was 813.48 and the minimum daily water level 810.36. Thus the variability in water level has been reduced from 6.33 ft in the pre-1960 period to 3.12 ft for the period following 1960. The average Lake Manitoba level prior to 1960 was 812.17 ft with an average level post-1960 of 811.92.

Table 4.4: Lake Manitoba Daily Water Levels in Feet (at Steep Rock) See also Appendix B.

Period	Maximum water level	Average water level	Minimum water level	Average annual range	Total range for period
Pre-1960	816.25	812.17	809.92	1.40	6.33
1960-1999	813.48	811.92	810.36	1.27	3.12
Differences between periods	2.77	0.25	-0.44	0.13	3.21

Conversely, the variability of Lake St. Martin water levels has increased from a calculated 5.14 ft under natural conditions for the period 1960-98 to 8.28 ft observed, with a minimum daily water level recorded of 794.54 ft asl and a maximum daily water level of 802.82 ft asl.

Table 4.5: Lake St. Martin Daily Water Levels in Feet. See also Appendix C.

Period	Maximum water level	Average water level	Minimum water level	Average annual range	Total range for period
1960-1998 Observed	802.82	799.01	794.54	3.07	8.28
1960-1998 Calculated Natural	800.29	798.08	795.15	1.65	5.14

A number of interested parties made presentations to the Committee with regard to water levels both upstream and downstream of the FRWCS and the operation of the structure itself. Their suggestions and recommendations are covered in Section 6.0 which deals with the various affected parties and interests.

4.3.3 The Portage Diversion

A frequent and significant contributor of water to Lake Manitoba is the Portage Diversion. Completed in 1970, the Diversion connects the Assiniboine River to Lake Manitoba from a point immediately west of the city of Portage la Prairie to south shore of Lake Manitoba at the Delta Marsh. This channel is one component of an overall flood protection network for Winnipeg.

Correspondence to the Committee from the City of Winnipeg has emphasized the importance of the Portage Diversion to the city [27].

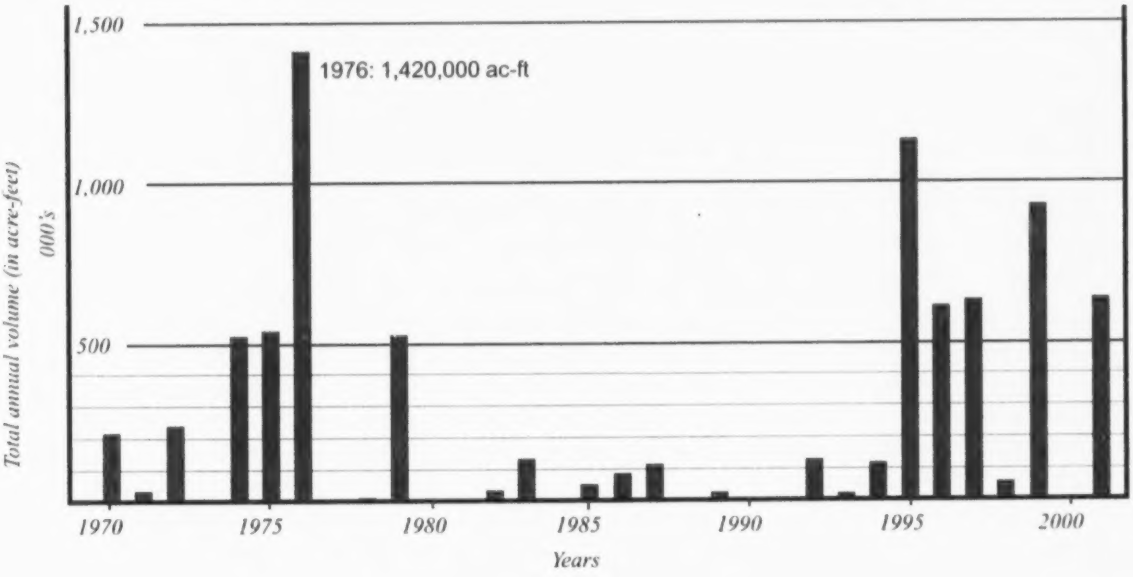
The Diversion also provides protection to farmland and communities along the Assiniboine River downstream of Portage la Prairie. In recent years, it has been used to supply water to farmers along its route for the purposes of irrigation

At the Committee's request, Steve Topping, Director of the Water Branch, Manitoba Conservation made an informational presentation to the Committee on the history and operation of the Portage Diversion. Following is a summary of information provided.

The 18-mile long Portage Diversion was first operated in 1970 and has been put into use 23 times in the 33 years since its completion. (Figure 4.2: The Portage Diversion – Years of operation and flows.) It has been operated as early as March and as late as June. The maximum capacity is 25,000 cfs. However, a "fail-safe" in the west embankment near the downstream end allows water to flow laterally from the channel into Delta Marsh when flows reach 15,000 cfs.

The largest impact of the Portage Diversion on Lake Manitoba occurred in 1976 when 1,420,000 acre-feet (ac-ft) of flow was diverted into the lake. This volume would have corresponded to a 1.22 ft increase in the water level on Lake Manitoba if all of the water had been retained in the lake. However, as lake levels increase, the outflow through the FRWCS also increases, thereby allowing some of this volume to flow out of the lake. The Water Branch estimates that the net impact of the Portage Diversion on the lake in 1976 was to add about 10 inches to the lake level.

Figure 4.2: The Portage Diversion – Years of operation and flows.



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[27] Correspondence from Barry D. McBride, P. Eng., Director of the Waste and Water Department, City of Winnipeg to the Lake Manitoba Regulation Review Advisory Committee, May 7, 2002.

The average annual volume of water directed into Lake Manitoba through the Diversion since 1970 is 246,774 ac-ft. This amount of water would account for a rise in Lake Manitoba water levels of about 2.6 inches. This small increase would have little impact on the outflow through the FRWCS, so the net impact on Lake Manitoba for a median diversion year would be to add approximately this amount to the lake.

During the period 1997 to 2002, dikes along the Assiniboine River east of Portage La Prairie were rehabilitated at 18 separate sites, amounting to a total of three miles of the 100 or so miles of dikes along the river. This action should increase the river capacity somewhat and may permit a slightly decreased use of the Portage Diversion, subject to ice conditions along the river.

The Portage Diversion Liaison Committee provides a communications link between the Province and local governments. The Committee was established in 1998 by the Water Branch in response to local governments who wanted to be kept better informed regarding the operation of the Diversion. The type of information provided typically includes items such as information on maintenance and construction work on the Diversion as well as the Assiniboine River, pre-flood information conditions, and ice conditions on the Assiniboine River and Lake Manitoba as they might affect the operation of the Diversion.

Membership on the Liaison Committee is flexible, and currently includes the rural municipalities of Cartier, St. Francis Xavier, Portage la Prairie and Headingley, the City of Winnipeg and Manitoba Conservation.

The Assiniboine River Management Advisory Board was established in 1994 to develop a sustainable water use strategy for the Manitoba portion of the Assiniboine River basin. Although currently inactive, the Advisory Board has representation from rural municipalities, towns, cities and a variety of groups having an interest in the management of the Assiniboine River. When active, the Board addressed issues of water management and water quality from the Shellmouth Reservoir to Winnipeg.

5.0 Water Quality

5.1 Introduction

From the outset, the Lake Manitoba Regulation Review Advisory Committee recognized that water quality in Lake Manitoba was an issue it wished to address. The Committee's Terms of Reference included the mandate to examine current water quality data and to compare the results with historical data to determine what, if any, changes have taken place in water quality in the lake over time.

The deterioration of water quality in Lake Manitoba was raised many times during the public meetings. Most who raised the issue (see Section 3: Public Meetings – Ron Coley, Alan Johnson, Dr. Wayne Cowan, Delta Beach Association, as examples) pointed to the transfer of Assiniboine River water through the Portage Diversion as a major contributor to water quality deterioration. Ron Coley also suggested that agricultural activity in the basin has lead to a reduction in water quality. The Woods Creek Cottagers Association, located in the most northwestern portion of the lake, also expressed a concern for agricultural runoff and added, that in their opinion, the transportation system (highways) also contribute impurities such as salt to the lake. The Association offered its support "dealing with" the elimination of pollution entering any water body.

The Committee requested the Water Quality Management Section of Manitoba Conservation to conduct a statistical analysis of water quality from existing data and to submit its findings to the Committee. The report was to focus on Lake Manitoba and the Assiniboine River immediately upstream of the Diversion. In addition, the Committee asked that water quality on the Whitemud and Waterhen rivers be included in the report. In addition, the impact of agricultural activities on water quality should be taken into consideration.

The preparation of an annotated bibliography of reports, files and other information relating to water quality in Lake Manitoba and associated areas was also commissioned by the Committee. It is anticipated that this bibliography will be an invaluable reference document for government, consultants and the general public. Both the report "An Overview of Water Quality in Lake Manitoba, Manitoba, Canada. Volume 1" and "An Annotated Bibliography on Lake Manitoba and Adjoining Waters." are available in electronic form and at the Province of Manitoba Legislative Library, 200 Vaughan Street in Winnipeg as well as at the Manitoba Conservation library.

5.2 Report: "An Overview of Water Quality in Lake Manitoba, Manitoba, Canada"

5.2.1 Lake Manitoba

The report "An Overview of Water Quality in Lake Manitoba, Manitoba, Canada" prepared for the Committee by Manitoba Conservation's Water Quality Management Section provides an overview of water quality in Lake Manitoba with an emphasis on the south basin. Where possible, water quality comparisons were made between the north and south basins. Water quality data extends back to 1928, but the majority of data were generated since the 1970s and more intensely in the 1990s. See Table 5.1. The current monitoring program consists of monthly measurements at a single site in the south basin of Lake Manitoba, monthly sampling of the Assiniboine River upstream of the Portage Diversion, and monthly sampling of the Whitemud, and Waterhen rivers. Limited information exists for water quality in the Fairford and Dauphin rivers, and for Pineimuta Lake and Lake St. Martin; no water quality monitoring is currently done at these places.

Table 5.1: Lake Manitoba Water Quality Monitoring sites

Site #	Location	Period of Record
WQ 0080	North Basin, east of Twin Islands	1973-77
WQ 0079	North Basin, north of Point Asham	1973-77; 1994
WQ 0078	North Basin, near Reed Island	1973-77; 1994
WQ 0077	South Basin, east of Duschame Island	1973-77; 1994
WQ 0076	South Basin, near Sandy Bay	1973-77; 1994
WQ 0075	South Basin, near Delta	1973-77
WQ 0597	South Basin, near Twin Lakes Beach	1980-83; 1994
WQ 0666	South Basin, near Delta Marsh Field Station	1991-present
WQ 1094	South Basin, near Whitemud River mouth	1994
WQ 1436	South Basin, Laurentia Beach area	1998
WQ 1744	South Basin, St. Ambroise Beach	1997-2000
WQ 1745	South Basin, Delta Beach	1997-2000
WQ 1746	South Basin, Lynchs Point Beach	1997-2000
C1,3,5,6,7,10,13	Various locations, north and south basins	1966-1969
C2,4,8,9,11,12	Various locations, north and south basins	Oct, 1966- Mar, 1967
Delta	South Basin, at Delta	1953-54
Oak Point	South Basin, at Oak Point	1953 (one sample)
Other	Various studies, various locations	1928; 1963; 1969; 1971; 1973

Sufficient data were available for 28 variables to make statistical comparisons between data collected during the 1970s and data collected beginning in the early 1990s. Data were statistically compared to determine if water quality conditions may have changed between time periods and to determine if there were differences between the north and south basins. As well, data were compared to Manitoba Water Quality Standards, Objectives and Guidelines necessary to support important water uses on Lake Manitoba.

The report concludes*: "Application of the Canadian Council of Ministers of the Environment's Water Quality Index (CCME WQI) indicates that water quality in Lake Manitoba ranges between "good" and "fair". This means that there are rare exceedances of Manitoba Water Quality Standards, Objectives, and Guidelines with occasional departure from desirable quality and that there is a minor or occasional degree of threat or impairment."*

The findings have been summarized in the report and are presented below as they appear in the report.

- There were statistically significant differences in colour and turbidity in the south basin between the 1970s and the 1990s. Available turbidity data from the 1950s appears similar to the 1990s while colour appears to have been slightly higher in the 1950s than during the 1970s or the 1990s.

- Generally, phosphorus appears higher in the south basin than in the north basin. There appears to have been an increase in phosphorus from the 1960s to the 1970s. Although there may have been some change between the 1970s to the 1990s, when the two sites near Delta were compared there was no significant difference in average total phosphorus.

- The south basin of Lake Manitoba is likely mesotrophic, as evidenced by both phosphorus and chlorophyll *a* concentrations. This implies that the lake is capable of supporting a healthy community of aquatic life, but nuisance blooms of algae may occur periodically.

- Salinity is relatively high in Lake Manitoba and much of this is thought to arise from the intrusion of saline groundwater at the west side of the lake. High salinity may interfere with the use of the lake as a source of water for domestic consumption and as a source of water for irrigation of some sensitive crops.

- The south basin of Lake Manitoba is relatively alkaline, with a pH of 8.5 or greater one-third of the time. This pH may cause eye irritation for some bathers.

- Relatively high bacteria densities occasionally have been detected near beach areas in the south basin of Lake Manitoba. Monitoring has indicated that these relatively high densities occur for only a short period of time, before returning to normal, low densities.

- Concentrations of trace elements and toxic metals such as arsenic, copper, nickel, plus others did not exceed Manitoba Water Quality Standards, Objectives, and Guidelines.

- The commonly used herbicide 2,4-D was detected on several occasions in Lake Manitoba, but did not exceed Manitoba Water Quality Standards, Objectives, and Guidelines.

- Dicamba, a herbicide often contained in formulations with 2,4-D, was detected on one occasion. The observed concentration was above the Manitoba Water Quality Standards, Objectives, and Guidelines for the protection of water used for irrigation.

- The herbicide MCPA was detected on two occasions. On these occasions, the observed concentrations exceeded Manitoba Water Quality Standards, Objectives, and Guidelines for the protection of water used for irrigation and for the protection of aquatic life. It is unlikely that water is used from this location for irrigation. Although some short-term effects on aquatic life potentially may have occurred, it is unlikely that long-term effects would have been realized since concentrations were less than the limit of detection on the next sampling occasion.

- Three main tributaries provide water to Lake Manitoba in addition to a small amount from local inflow. The Waterhen River accounts for about 80 to 90 per cent of the water entering Lake Manitoba. The Waterhen River influences water quality mainly in the north basin. The Whitemud River and Assiniboine Diversion account for the remaining 10 to 20 per cent and exert water quality influences mainly in the south basin. As expected, cursory water quality modeling indicates that water quality changes in Lake Manitoba track changes observed in the tributary streams, but the amplitude of changes are moderated in the lake.

Figure 5.1: Water Quality Monitoring Sites on Lake Manitoba and Associated Rivers.

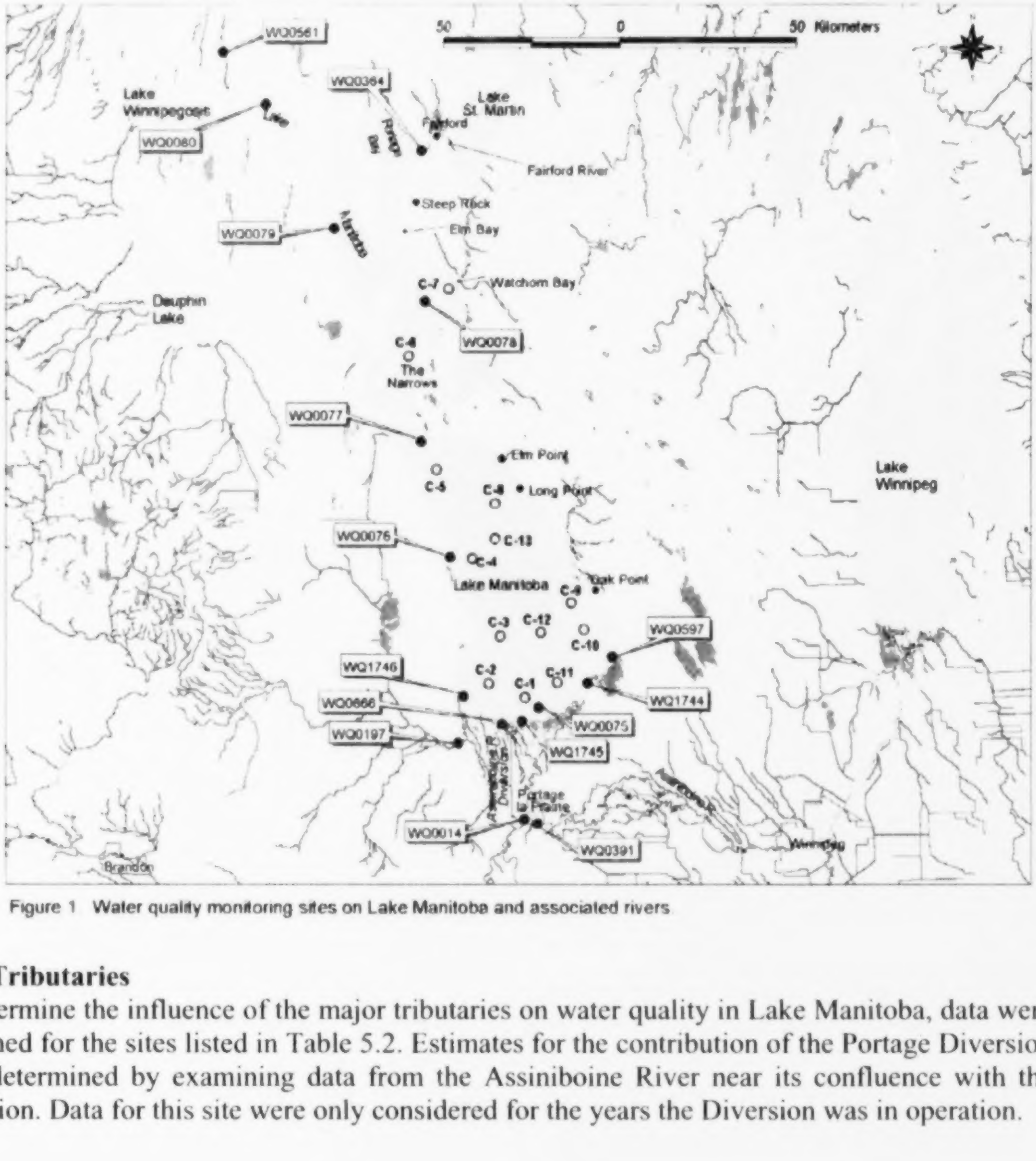

WQ0561
50
0
50 Kilometers
Lake Winnipegosis
WQ0080
WQ0364
Lake St. Martin
Fairford
Fairford River
Steep Rock
Elm Bay
WQ0079
C-7
Watchorn Bay
Dauphin Lake
WQ0078
The Narrows
WQ0077
Elm Point
C-5
C-8
Long Point
Lake Winnipeg
WQ0076
C-13
C-4
Lake Manitoba
C-9
Oak Point
WQ0597
C-3
C-12
C-10
WQ1746
C-2
C-1
C-11
WQ1744
WQ0666
WQ0075
WQ0197
WQ1745
Portage la Prairie
WQ0014
WQ0391
Winnipeg
Brandon

Figure 1 Water quality monitoring sites on Lake Manitoba and associated rivers

5.2.2 Tributaries

To determine the influence of the major tributaries on water quality in Lake Manitoba, data were examined for the sites listed in Table 5.2. Estimates for the contribution of the Portage Diversion were determined by examining data from the Assiniboine River near its confluence with the Diversion. Data for this site were only considered for the years the Diversion was in operation.

The Waterhen River contributes 80 to 90 per cent of the stream flow to Lake Manitoba, with the Whitemud River and the Portage Diversion contributing the remainder. Cursory water quality modeling indicates water quality changes in Lake Manitoba track changes in the tributaries, but the amplitude of the changes are moderated in the lake.

Table 5.2: Water Quality Monitoring Sites, Tributaries to Lake Manitoba

Site #	Location	Period of Record
WQ 0014	Assiniboine River at Portage Diversion	1971 - present (only for years of operation)
WQ 0197	Whitemud River at Westbourne	1973-1984; 1986 - present
WQ 0561	Waterhen River at Waterhen	1981-84; 1987 - present
WQ 0364	Fairford River at PTH 6	1978-1984; 1994

Study highlights concerning the tributaries to Lake Manitoba are summarized below. A more detailed description appears in the report.

During the 19 years of record, contribution of total suspended solids (TSS) was dominated by the Waterhen River in 10 years and by the Portage Diversion in nine years. During that 19-year period, the Diversion did not operate in six years. While operating, the Diversion tended to carry higher sediment loads than the Waterhen River. There was no significant trend in TSS concentrations in Lake Manitoba near Delta Marsh for the period 1991 to 2001.

During 11 of the 18 years of record for phosphorus, the Waterhen River accounted for the largest portion of phosphorus added to the lake, while the Portage Diversion dominated during seven years. However, the Diversion did not operate during seven of the 18 years. There has been a significant increase in phosphorus off shore from Delta Marsh since 1991, likely due, at least in part, to contributions from the Diversion. During the years when it is operated, the Portage Diversion is often the predominate contributor of suspended solids and phosphorus.

For Kjeldahl nitrogen and nitrate-nitrite, the Waterhen predominated during 17 of the 18 years of record, with the Diversion dominating in 1995 only. Nitrite-nitrite nitrogen contributions were split evenly between the Waterhen and the Diversion with the Whitemud River contributing the highest amount in 1982 only.

There were clear parallels between lake averages and estimated average tributary contributions of specific conductivity, total dissolved solids and some major ions such as sodium and chloride. It appears each of these variables has been relatively stable or may have decreased somewhat between 1991 and 2001.

Average pH in Lake Manitoba between 1991 and 2001 has been relatively stable while the average pH in the tributaries has been more variable. In all 19 years of record, the Waterhen River has been the major influence on pH in the lake.

5.2.3 Committee evaluation of the water quality report

The report summarizes a large amount of data collected from Lake Manitoba over a period of about 75 years. It provides an initial assessment of water quality trends, concluding that, with a few minor exceptions, it falls within the "fair" to "good" regulatory categories. The scope of the final document was determined largely by time and resources constraints during its preparation. As a result, the following issues should be addressed before any conclusions can be drawn about water quality trends:

- Water quality monitoring since the 1920s has focussed almost entirely on Lake Manitoba. As a result, there are insufficient data to enable an assessment of water quality in the Fairford and Dauphin rivers, or in Pineimuta Lake and Lake St. Martin.

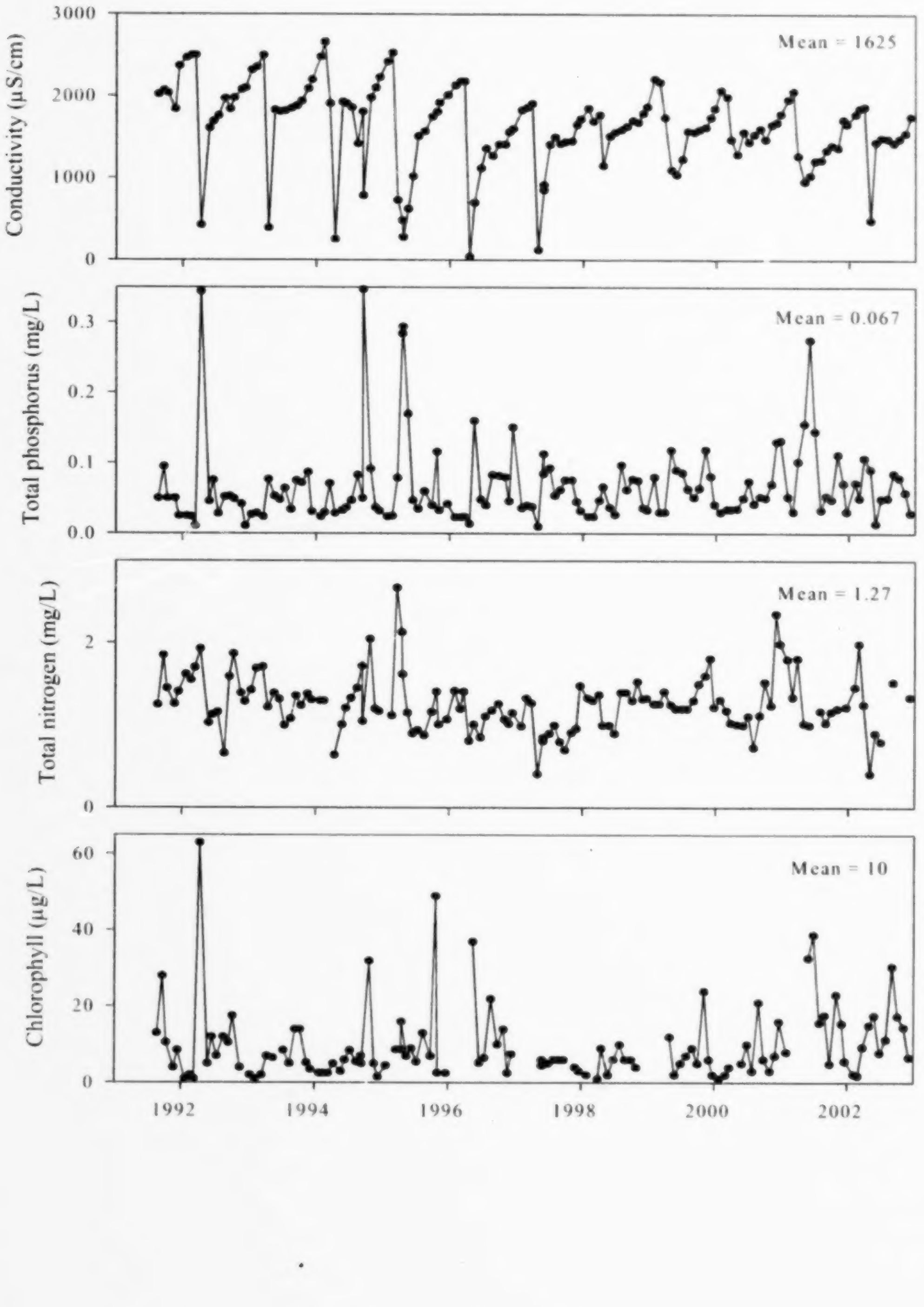
- There has been no critical evaluation of Lake Manitoba's present monitoring infrastructure for representing lake-wide trends in water quality, beyond a preliminary analysis of differences between the north and south basins based on relatively few samples. There is, at present, a single routine water collection site located in the south basin close to shore. There are no pelagic (deeper water, off-shore) sites, where the influence of shoreline processes and the surrounding landscape are reduced, and none in the north basin.

- Comparison of chemistry data between the 1920s, 1960s, 1970s, and 1990s has not fully taken into account the possibility that observed differences have arisen from differences in lake water level (and hence water inflow, mixing, and outflow) rather than real long-term trends. Changes in analytical methods over time, and improvements in sensitivity, may also affect the outcome of comparisons over time.

- There has been only cursory analysis of trends within the water quality data collected monthly in the south basin of the lake from 1991 to present. These data have been mostly aggregated as a single overall average and compared to values for other time periods. Such contrasts are confounded by the fact that data collections in the past have not been done consistently at the same sites and at the same times of year. Where monthly data have been examined, apparent trends have not been tested and evaluated statistically. There appears to have been consistent changes in such parameters as total phosphorus concentration and conductivity within the past 12 years (Figure 5.2: Water Quality Trends, 1991 – Present), and more detailed analysis of trends in other important variables such as chlorophyll concentration, total nitrogen, and major ions should be done.

- The role of the Portage Diversion in affecting water quality in Lake Manitoba has not been examined critically. An attempt to consider its contribution to the total phosphorus input to the lake was done using the annual average value at a site in the Assiniboine River, upstream of the Diversion channel. This approach probably underestimates the values existing during the spring snow melt, when most of the flow occurs in the Diversion. No analysis of water quality in the Diversion channel itself has been done.
- Besides data arising from water sample analysis, other potential sources of water quality information, such as aerial photography and satellite imagery of Lake Manitoba, would be useful in evaluating lake-wide differences in water quality through time.

Figure 5.2: Water Quality Trends, 1991 to present. Prepared by the Committee



5.3 Bibliography

In conjunction with the water quality study, a bibliography[28] was prepared with the intent to compile all substantive references addressing the current and historical biological health of Lake Manitoba. Approximately 400 publications are included, spanning a period of over 125 years, with publications as early as 1876 included, continuing up until the beginning of 2002. The content of each publication has been concisely summarized.

Selected water bodies that surround Lake Manitoba including Lake St. Martin, the Waterhen Watershed, Pineimuta Lake and Marsh, Dauphin River, Fairford River, the Whitemud Watershed, and Delta Marsh have also been included in the bibliography. The lower Assiniboine River, from Brandon to the Portage Diversion, and the Portage Diversion are also included.

In terms of biological health, publications dealing with historical and current water quality conditions and water levels, and their effects in the above mentioned water bodies have been included in the bibliography. The effects of water quality and water levels include effects on the physical, chemical and biological features of the ecosystem. Publications containing information on historical regulation of Lake Manitoba and water levels in the lake have also been included.

In addition, a summary table in the publication exemplifies specific subject material that is contained in the publications such as various water quality parameters, and information on fisheries, flora, fauna, agriculture, recreational usage, and soils and geology. A brief list of historical photographs of Lake Manitoba, and select surrounding water bodies is also provided.

Due to the expansive amount of publications that have resulted from research studies that have been conducted at Delta Marsh, only those that directly relate to biological, chemical and other influences from Lake Manitoba on the marsh and surrounding area, and influences on the lake from the surrounding watershed, are included in this bibliography.

Publications are being added monthly to the Manitoba Conservation and Environment Library. As a result, additional publications on Lake Manitoba and the other surrounding water bodies may not have been included in this bibliography because of inaccessibility at the time of preparation.

5.3.1 Committee evaluation of the water quality bibliography

The report summarizes a large body of existing information which should be a useful background for future studies. Terms of reference for the preparation of the bibliography were provided by the Committee. Any short-comings in the bibliography are related to the short time period and limited resources available during its compilation, and not through any fault of the author.

In that context, the drawbacks to the document are discussed below.

- It is unlikely that the bibliography includes all data available on Lake Manitoba. There is probably more material to be found in dormant files deposited at the

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[28] Bortoluzzi, T.L. 2002. "An annotated bibliography on Lake Manitoba and adjoining waters." Delta Marsh Field Station, University of Manitoba. Occasional publication No. 3.

Provincial Archives of Manitoba and in storage at various government offices, in government reports that were unpublished or which had few copies made, and in the files of private persons, consultants, university personnel, and others.

- The report provides only summaries of the contents of the documents listed. It does not assess their quality or address methodological and other flaws that could compromise their utility.

- The report provides no synthesis of the documents as a whole. It does not identify areas of incomplete or absent information which could be useful in focussing future initiatives.

- The source of each document, where available, was noted. However, those in private hands may become unavailable to future researchers. Some documents in public sources have already gone missing, and it is probable that others will be lost as government and university staff retire. It would be desirable for copies of all documents to be made as a comprehensive and readily accessible resource.

6.0 Interests and Affected Parties

6.1 Agriculture

6.1.1 Introduction

The Lake Manitoba basin supports a cattle industry that is important to the economies of many local communities, the region in general and the province as a whole. The industry is dependent upon feed grains, alfalfa and other forages grown in upland areas as well as on native hay harvested from the regions adjacent to the shorelines and marshes of Lake Manitoba, Pineimuta Lake and Lake St. Martin.

According to previous Manitoba Water Commission reports, approximately 40 per cent of the total acreage of the farms adjacent to Lake Manitoba consist of lands from which native hay is harvested. The remaining acreages on these farms are predominantly utilized for pasture.

Manitoba Agriculture and Food data (Program and Policy Analysis Branch) indicates there are more than 1,500 cattle producers within the municipalities surrounding these lakes, and nearly 260,000 head of cattle. The numbers of cattle producers with pasture land actually bordering the lakes, or who are dependent upon native hay from shoreline hayland is uncertain. However, estimates obtained from Manitoba Agriculture and Food regional staff range from 200 to 300 producers with 8,000 to 15,000 cows actually impacted by water levels on the lakes.

The Fairford River Water Control Structure (FRWCS) was built and completed in 1960/61 largely in response to the high Lake Manitoba water levels of the mid 1950s. At the highest water level during this period, some 63,000 hectares of agricultural lands were inundated with an estimated agricultural loss of $1.6 million (Lakes Winnipeg and Manitoba Board, 1958). The manner and level to which Lake Manitoba is regulated, therefore, is of importance to ranchers around Lake Manitoba and their counterparts downstream along the Fairford River and Lake St. Martin.

6.1.2 Public Meetings

Issues related to Lake Manitoba regulation and the cattle industry were raised frequently during the public meetings. Although occasional loss of pasture to flooding was a concern, the major issue was related to the loss of the valuable native hay resource through chronic and unpredictable inundation.

The native hay consists of many species of grass varying from coarse marsh grasses to native upland species. The success of individual species of grass depends *at least to some extent* on the degree and duration of flooding. Ranchers and others indicated that the yield of the marsh species is improved when the land is submerged during the initial growing period and subsequently drained by the third week of June. On the other hand, the upland species cannot tolerate flooding beyond the beginning of the frost-free period which commences during the latter part of May.

The Manitoba Cattle Producers Association, among others, have indicated that because of a number of years of flooding, the ecology of the native grasses has changed, and not for the better. According to some presenters, whitetop grass, one of the more desirable native grass species, has been significantly reduced by higher, stable water levels.

In addition to flooding along the Lake Manitoba shoreline itself, high water frequently spills into swales and other low areas back from the lakeshore. Because of the natural ridge and swale topography, it cannot return to the lake when lake levels drop. The only way these areas can dry up is through evaporation. This can lead to native hay losses and reduced pasture land over an entire year or more. In the Lake St. Martin area in particular, there was a concern over pasture and hayland lost to frequent and unpredictable flooding.

6.1.3 Discussion

Native hay is heavily relied upon for over-wintering herds in the area. Without enough hay, many producers have to purchase feed, or reduce their herd sizes, perhaps during times of unfavourable market conditions. Either action has the potential to threaten the economic viability of their operations.

But, in general, ranchers recognize that they cannot count on an optimum native hay harvest every year; that lake levels will fluctuate. They also recognize that occasional flooding is good for the native grasses and the soil. Ranchers indicated during the public meetings, as well as through their representative on the Advisory Committee, they would prefer Lake Manitoba water levels near the current target level of 812.17 ft asl in the spring, and dropping to a level of 811.0 to 811.5 by about the end of June. Harvesting of native hay by the ranchers is normally underway by early July and continues through August.

There were also concerns expressed by presenters that the Portage Diversion is operated without concern for the ranchers. They suggested closing the Diversion earlier in the season to allow high water to recede in time for the hay harvest.

6.2 Cottage Owners and Tourist Operators

6.2.1 Introduction

There are approximately 1,700 cottage properties along Lake Manitoba. A number of cottage owner associations as well as individual cottage owners either made presentations to the Advisory Committee or were in contact at various times throughout the summer and early fall regarding water levels.

6.2.2 Public Meetings

The Twin Lakes Beach and Delta Beach Cottage Owners Associations each appeared before the Advisory Committee at its public meetings. Combined, they represent about 650 cottagers and permanent residents.

The Twin Lakes Beach Association indicated that the current target level of 812.17 ft asl, which is the approximate long-term average level of the lake, was unacceptable to them as a target. They claim at this elevation, lake levels could quickly increase to 812.5 ft asl or higher, the elevation where their properties are severely endangered by strong northerly winds and the resulting setup and wave action. They contend that at a level of 813.0 ft asl, even a mild storm will almost certainly cause damage to the shoreline, shoreline vegetation, boat houses, cottages and permanent homes when coupled with wind setup and wave up-rush. They prefer a lake level as fall approaches in the range of 811.0 - 811.5 ft asl.

Delta Beach residents hold similar opinions with regard to lake levels. In their opinion, the water levels of the summer of 2002 (approximately 811.0 – 811.5) were ideal for them.

Cottage owners and residents at Laurentia and Lundar Beaches and Sugar Point in the southern portion of the south basin, Manitowapa near the Narrows, and at Woods Creek in the northwestern portion of the north basin all complained about low water levels. Low water has detrimental effects on ease of access for swimming, boat launching and the general use of watercraft. Weed growth, accelerated under low water conditions, presents a hazard or nuisance to both boating and swimming as do rocks which become exposed or worse, remain just slightly submerged, out of sight.

Tourist operators, both at the Narrows and at Lake St. Martin expressed a desire for stable levels in a range where they could have good access to their docks for boating. While touring the area, the Committee members particularly noticed the effect of the low water levels on Big Rock campground, a tourist camp at Lake St. Martin.

Cottagers generally expressed a concern with the operation of the Portage Diversion and its effect on water levels and quality. Delta Beach cottagers expressed a specific concern with trash accumulating on their beach in years when the Diversion is operated and the length of time it took for the Province to clean up the beach.

6.2.3 The Shoreline Erosion Process – Dr. Jay Doering

Dr. Jay Doering with the Faculty of Engineering at the University of Manitoba appeared before the Lake Manitoba Regulation Review Advisory Committee to describe the natural process of shoreline erosion. His presentation is summarized below.

The interaction between shoreline position, water level and wave action is very complex. Whether a shoreline experiences accretion (accumulation of material) or erosion depends on the availability of littoral material (the littoral zone is that area from the shoreline to just beyond the breaker zone) and the composition of the shoreline material itself. Shorelines are broadly classified as granular or cohesive.

Granular shorelines can erode or accrete and have an "equilibrium" profile, albeit a dynamic equilibrium. When a granular shoreline is subject to wave attack it erodes. The eroded material is moved offshore, where it is available for suspension and deposition by waves during relatively low energy conditions. The cycle of erosion and accretion on a granular beach is known as "dynamic equilibrium."

If a dynamic equilibrium exists on a granular beach and a relatively sudden increase in water level occurs, the equilibrium position of the shoreline will migrate onshore. Conversely, if the water level decreases relatively suddenly the equilibrium position of the shoreline will migrate offshore. On a granular beach the location of the shoreline can migrate both onshore and offshore in response to a change in water level or wave conditions; any erosion or accretion is recoverable. The shoreline is in a state of dynamic equilibrium with the water level and wave conditions.

The shorelines along the south basin of Lake Manitoba are primarily granular in composition. Examples include the beaches at Delta and Twin Lakes.

Where the shoreline consists of cohesive or non-granular material the cycle of accretion and erosion (i.e., dynamic equilibrium) does not exist. This is because cohesive shorelines, which are characterized by low to steep bluffs, do not accrete. They only erode. Although an equilibrium profile exists on a cohesive shoreline, profile adjustment occurs only by a shore migration of the equilibrium profile. Erosion on a cohesive shoreline occurs by down-cutting of the foreshore (the submerged portion of the beach just offshore) or by undercutting of the toe of the bluff. Both actions cause sloughing of the bluff and shoreline loss. If the water level increases on a cohesive shoreline the equilibrium profile will shift landward - a loss of beach. If the water level decreases there is an apparent temporary cessation of bluff erosion. However, erosion continues unseen in the foreshore and will again establish an equilibrium profile.

6.2.4 Discussion

Cottage owners are generally divided with respect to their position as to the optimum level on Lake Manitoba. Those in the southernmost portion of the lake want lower levels (811.0 – 811.5 ft asl) in order to prevent or reduce erosion, particularly in the fall when the high winds from the north are most likely occur. Cottagers in the northern areas of the lake would like higher levels.

Cottage owners at Twin Lakes Beach have suffered extensive erosion damage to their land and buildings over the past several years. The November 1, 1999 storm caused extensive damage, estimated at $1 million by the property owners affected. Three cottages were lost and about 20 more sustained significant damage. Three boat houses were also lost and many more damaged. The main road was washed out in four locations, 30 erosion protection structures were lost and at least 200 trees on the shoreline were destroyed. The wind-eliminated lake level at the time was 811.8 ft asl. However, wind setup and wave up-rush added significantly to the problem.

There is a water level recording gauge on Lake Manitoba near Westbourne, but no official water level recording stations in the southeastern portion of the south basin of Lake Manitoba. The maximum setup at Westbourne was 2.7 feet in 1964. By extrapolating data from Lake Winnipeg, the maximum setup that could occur in the area from Delta Beach to Twin Lakes Beach has been estimated at about four feet[29]. Wave up-rush would be additional. However, the wind setup and wave up-rush during the November 1, 1999 storm is difficult to determine with any certainty.

The November 1, 1999 storm had sustained winds from 40 to 60 kilometres per hour (kph), and gusts from 80 to 100 kph. (Figure 6.1, drawn from wind data recorded at the Delta Marsh Field Station.) A return period for this storm has not been calculated, but it would likely be between 25 and 50 years (Warkentin). One of the worst storms on record (since 1964) occurred on May 21/22, 2001 which produced sustained winds of 60-80 kilometres per hour. It produced a wind setup of 1.6 feet at Westbourne and 3.25 feet at Victoria Beach on Lake Winnipeg. Its return period has been estimated at about 50 years (Warkentin). Over the past 40 years, other significant storms have occurred in November 1997, November 1986, April 1984 and July 1968.

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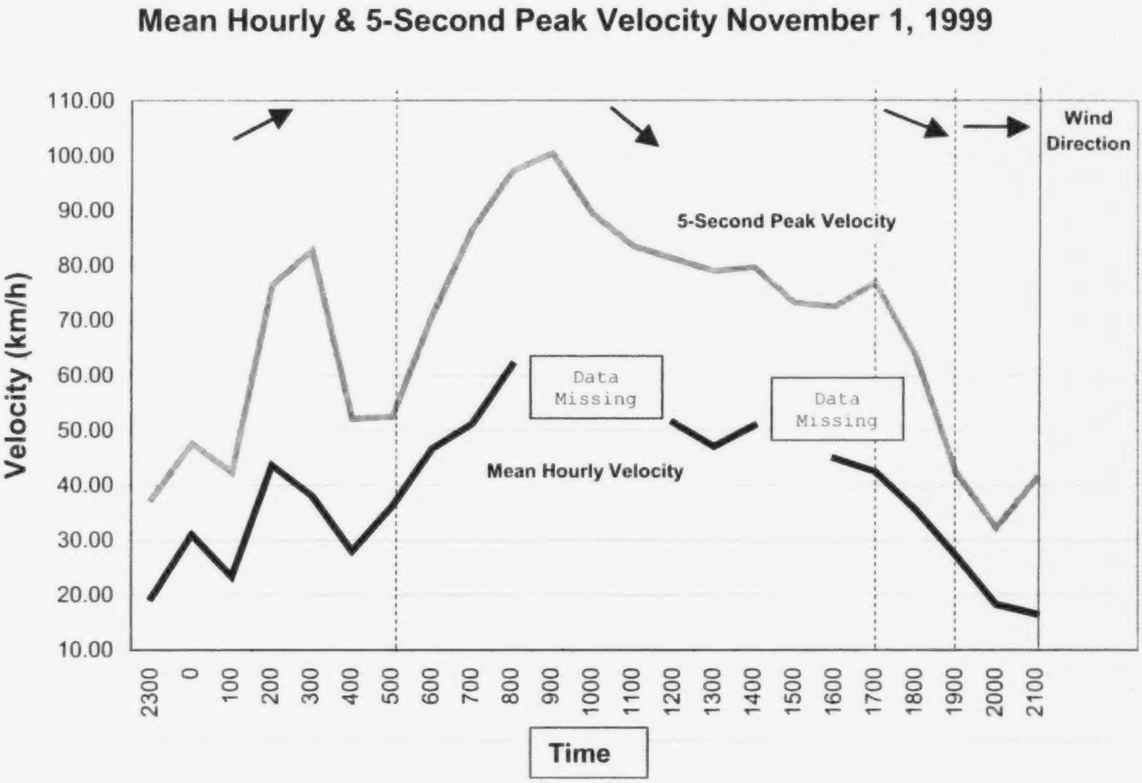
[29] Alf Warkentin, Water Branch, Manitoba Conservation.

Figure 6.1: Wind velocities and directions, November 1, 1999, Delta Beach (Prepared by the Committee using weather data supplied by the Delta Marsh Field Station, University of Manitoba.)



The return rate for a particular intensity of storm is based on the statistical probability of its occurrence. For example, a one-in-a-hundred year storm has a one per cent probability of occurring in any given year. It is possible for a storm of such magnitude to occur in back-to-back years, or even more than once in a single year.

Cottage owners and tourist operators in the north basin prefer higher water levels for convenience of access for boating and swimming as well as general use of watercraft. They point out that higher water will help to reduce weed growth which can present a hazard or nuisance to both boating and swimming. In shallow water, rocks may become exposed or worse, remain just slightly submerged but out of sight. Tourist operators in the area complained of low water levels in the fall of 2002, which extended into winter.

While these concerns are more a matter of convenience than financial losses, the Advisory Committee recognizes the importance of these issues to these cottagers who built with the knowledge that the target lake level was the accepted long-term average level of 812.17 ft asl.

On Lake St. Martin and downstream along the Dauphin River, tourist operators also want higher, and more stable water levels. The current low water levels (2003) are having a serious impact on the viability of these operations.

6.3 Commercial Fisheries

6.3.1 Introduction

Historically, Lake Manitoba has been the third most important fishery in the province overall, and the largest winter fishery in the province in terms of total weight caught.

Figure 6.2 prepared by the Committee, shows the total catch of the fishery (in pounds) for the period 1886 to the present. Except for some minor variances, it generally shows a marked reduction in the annual catch since the early 1960s.

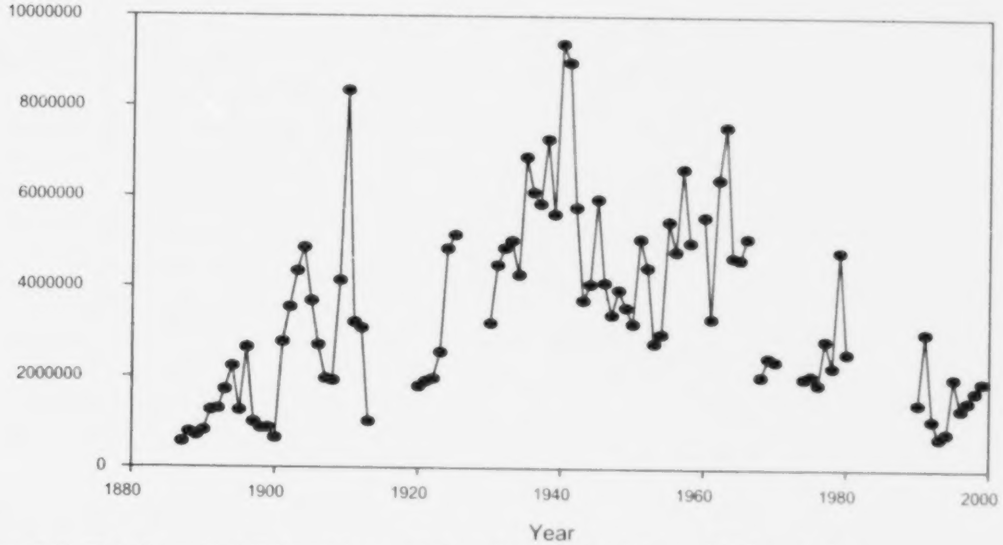


Figure 6.2. Total annual fishery (pounds) in Lake Manitoba, 1886 to 1999.
(Prepared by the Committee)

Data were obtained from various sources, including the Sessional Papers of the Canadian Parliament (1886 to 1920), National Archives of Canada (1920s), Manitoba Conservation (1930s to 1980), and the Freshwater Fish Marketing Corporation (1990s).

Figure 6.3, also prepared by the Committee, indicates the annual catch for the period 1931 to 2000 by species. These illustrations show a significant decline in the walleye catch. Whitefish, the mainstay of the fishery at the turn of the 20th century, is also no longer a significant species while the perch catch has increased over the past 10 years. Coarse fish such as suckers (mullet) and carp have increased significantly, particularly over the last 20 years in the case of carp.

While there are varying opinions among Committee members regarding the reasons for population declines and shifts in species composition of the total catch, the Committee as a whole does not feel adequately informed to support any particular view at this point.

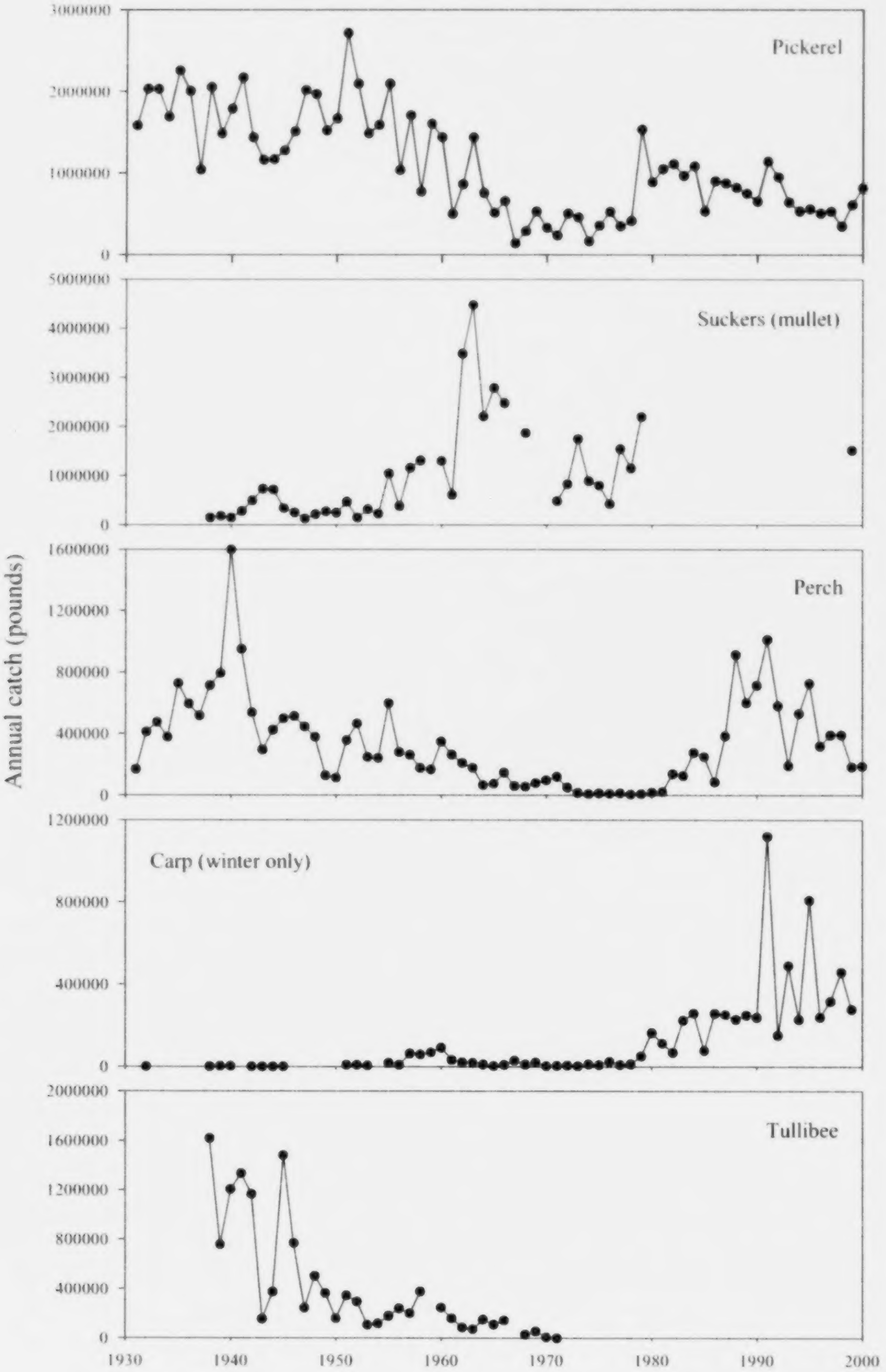


Figure 6.3. Change in species in the annual winter catch on Lake Manitoba, 1931 to 2000. (Prepared by the Committee)

6.3.2 Public Meetings

The Lake Manitoba Commercial Fishing Association expressed concern to the Committee with regard to a decline over the past number of years in annual yield, particularly with regard to walleye. A number of fishers expressed the same concern as did the First Nations with respect to the Lake St. Martin fishery. Most blamed the yield decline on the FRWCS which they felt limited the movement of fish upstream from Lake St. Martin and the Dauphin and Fairford rivers into Lake Manitoba as well as restricting movement in the opposite direction. Also, the fluctuations of water levels in Lake St. Martin and on the Dauphin River were considered negative factors in respect to the fishery.

A suspected decrease in water clarity and quality as a result of construction and operation of the Portage Diversion was also given as a reason for the decline of the fishery. The Diversion was first operated in 1970.

6.3.3 Manitoba Conservation – Fisheries Branch

Walter Lysack, fisheries biologist with Manitoba Conservation, provided a great deal of data and general information about the Lake Manitoba commercial fishery to the Committee on behalf of the Fisheries Branch. This was accomplished through a formal presentation to the Committee and through subsequent updating of the information included in the presentation.

The Fisheries Branch has attempted to correlate annual yield with a number of factors for the period 1970 to the present. These factors include annual fishing effort, water levels, flow rates, the introduction of the 3-inch gill net in the mid-1980s and subsequently the use of monofilament gill nets beginning in 1991.

The Branch contends there is a strong relationship between annual yield and fishing effort. See Figure 6.3, prepared by the Fisheries Branch. While the stock responds to an increase in fishing effort, this is not instantaneous because of age group distribution.

Figure 6.4, also provided by Fisheries Branch, suggests that there is little or no relationship between flow rates and lake levels and the walleye and sauger catch. Yields do not seem to correlate to varying lake levels as represented by the years from 1970 to 2000. The Fisheries Branch also indicates that it has not been able to interpret any causal relationships between annual catches and Portage Diversion flows.

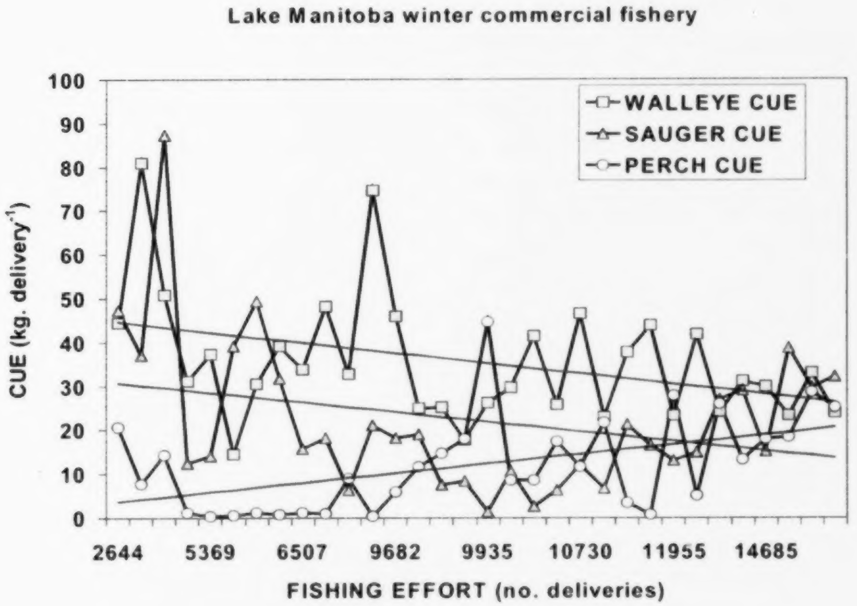
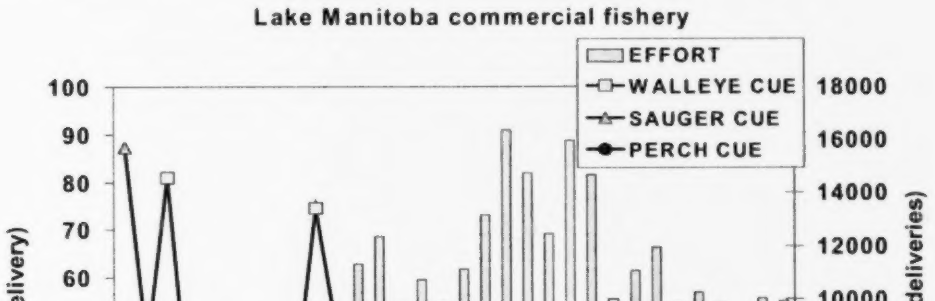


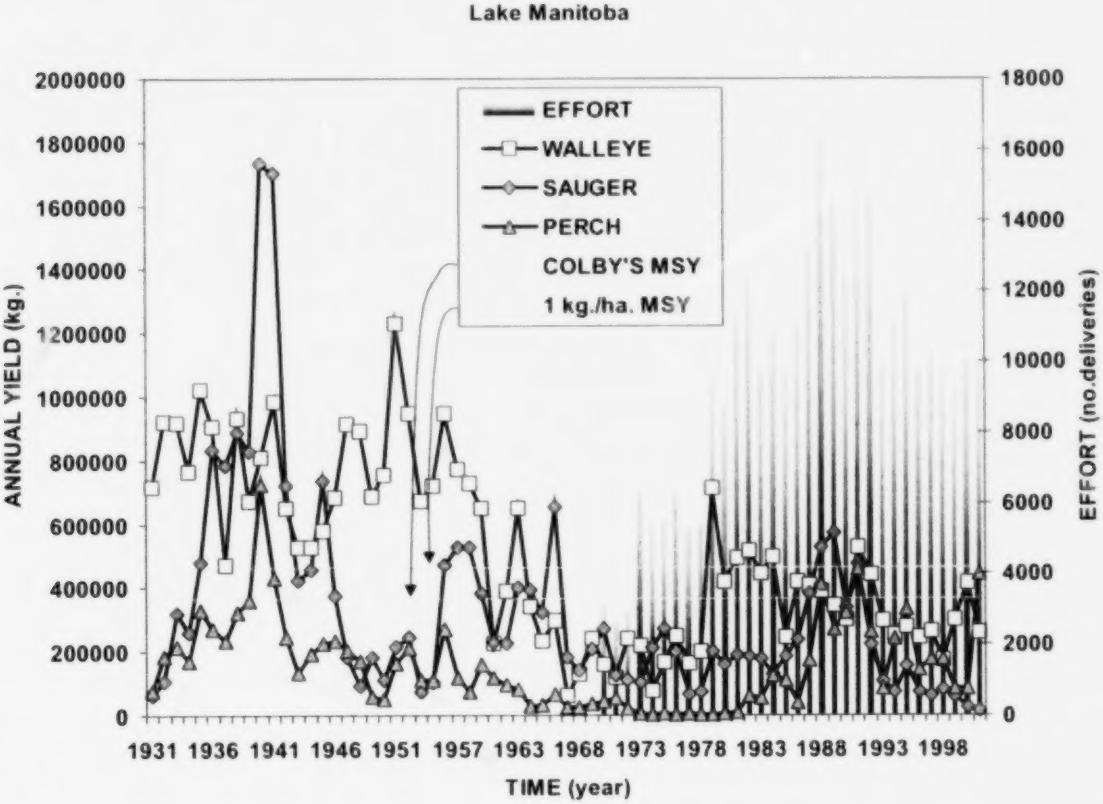
Figure 6.3 Above: Effort and Yield
(Note: CUE: Catch per Unit of Effort)

Figure 6.4 Below: Yield Over Time



Finally, Figure 6.5, prepared by the Fisheries Branch, suggests that whenever the annual yield of walleye exceeds one kilogram per hectare (kg/ha) the catch will eventually fall off to, or below, a line depicting the one kg/ha yield and will remain below that line until the fish stock has had an opportunity to regenerate itself.

Figure 6.5: Yield vs. Population



Other factors influence the fish stock on Lake Manitoba. On the positive side is the large number of fry introduced to the lake each year by the Lake Manitoba Commercial Fishing Association. On the negative side, commercial fishers and cottage owners on the northern portion of the lake claim there are a huge number of small fish devoured by the increasing number of cormorants on the lake. However, Fisheries Branch staff are of the opinion that the main cormorant diet is small suckers, tulibee and perch, and not sauger and walleye.

Also, it was suggested to the Committee that large amounts of fish were sold other than through the Freshwater Fish Marketing Board and thus not accounted for. In addition, catches for domestic use are not recorded.

6.3.4 Fairford River Water Control Structure Fish Ladder

As previously indicated, concern was expressed at the public meetings by the Lake Manitoba Commercial Fishing Association and a number of individuals with respect to the passage of fish through the FRWCS. When first constructed, apertures about two feet square in size were left in both the endsill and headwall of Bay 9 of the structure to form a crude form of fish passage through the dam[30]. There is no evidence to suggest that this fishway was ever effective in passing fish upstream.

Subsequently, a state-of the-art denil-type fishway was constructed starting in December of 1983 with completion in January 1984 in time for the spring spawning season.

In 1987, A.J. Derksen of Manitoba Conservation's Fisheries Branch conducted an evaluation of the newly installed fish ladder. In his report[31], Derksen noted that as early as 1963, commercial fishers on lakes Manitoba and Winnipegosis had expressed concerns that fish were leaving their lakes via the Fairford River and could not return because of the dam. He indicated that fish tagging studies in response to those concerns did not confirm any significant movement of fish to the Fairford River. However, since the Canada Fisheries Act required that any water control structure in an area containing significant fish populations had to be equipped with a functional fish ladder, the new fish ladder was installed.

Derksen's evaluation of the fishway was conducted in May - June of 1987. His evaluation concluded that the fishway was effective in passing most species and sizes of fish found in the Fairford River under most flow conditions. It also concluded that it could only be speculated as to how effectively fish would pass through the structure under extreme flow conditions, both high and low.

The study states that while it provided a good assessment of effectiveness of the fishway in passing fish, a number of questions remain unanswered. The most obvious gap was the lack of information during the spawning-run period. The assessment, conducted in May and June, began after the peak walleye spawning season.

Also, while the study indicated that lake whitefish used the fishway, it would be necessary to conduct an assessment in the fall to determine the significance of the fishway to lake whitefish stock. Also, placing the stoplogs in the dam in such a manner that most of the flow passes over the dam in the vicinity of the fishway may attract fish, resulting in more fish being better able to find the entrance to the fishway.

The study did not adequately investigate the effectiveness of the fishway for all fish stocks in the area. While it provided some insight into the effect of the fishway on walleye stocks, it raised other questions such as why were the walleye using the fishway to move upstream. Thus,

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[30] Warachka, M. Province of Manitoba, Department of Natural Resources, Engineering and Construction Branch. 1984. Construction Report, Fairford Dam Fish Ladder and Flume.

[31] Derksen, A. J. Manitoba Natural Resources, Fisheries Branch. 1988. Manuscript Report No. 88-6. An evaluation of the Fairford Dam fishway, May-June, 1987, with observations on fish movements and sport fishing in the Fairford River.

Derksen posed the question: was the walleye movement a response to river flows or did it represent a return migration from spawning? In addition, he questioned whether the walleye in the area represented a discrete population.

In order to obtain a more complete assessment of the effectiveness of the fishway the study recommended a more complete monitoring project be conducted which would include season-long monitoring and additional fish tagging studies.

Mr. Chris Katapodis, an internationally recognized expert in fishways, appeared before the Lake Manitoba Regulation Review Advisory Committee in July of 2002. During his presentation he advised the Committee that the Denil design of the fishway, along with the fish attraction flume beside it, remains a viable fish passage facility, provided the structure is maintained and operated properly. However, whether the fishway allows the passage of the same number of fish as would have occurred prior to construction of the dam is a question that, in his opinion, cannot be answered. Mr. Katapodis also recommended further fish tagging programs be conducted to gain additional knowledge regarding use of the fishway.

The Committee accepts that the fishway is state-of-the-art, but recognizes that the manner in which it is operated, maintained and managed could have an impact on its effectiveness. In addition, the Committee was unable to locate operating records for the fishway.

The effectiveness of the fishway in its current environment and related operating procedures remain open questions to the Committee. The Committee feels more research should be conducted in this regard.

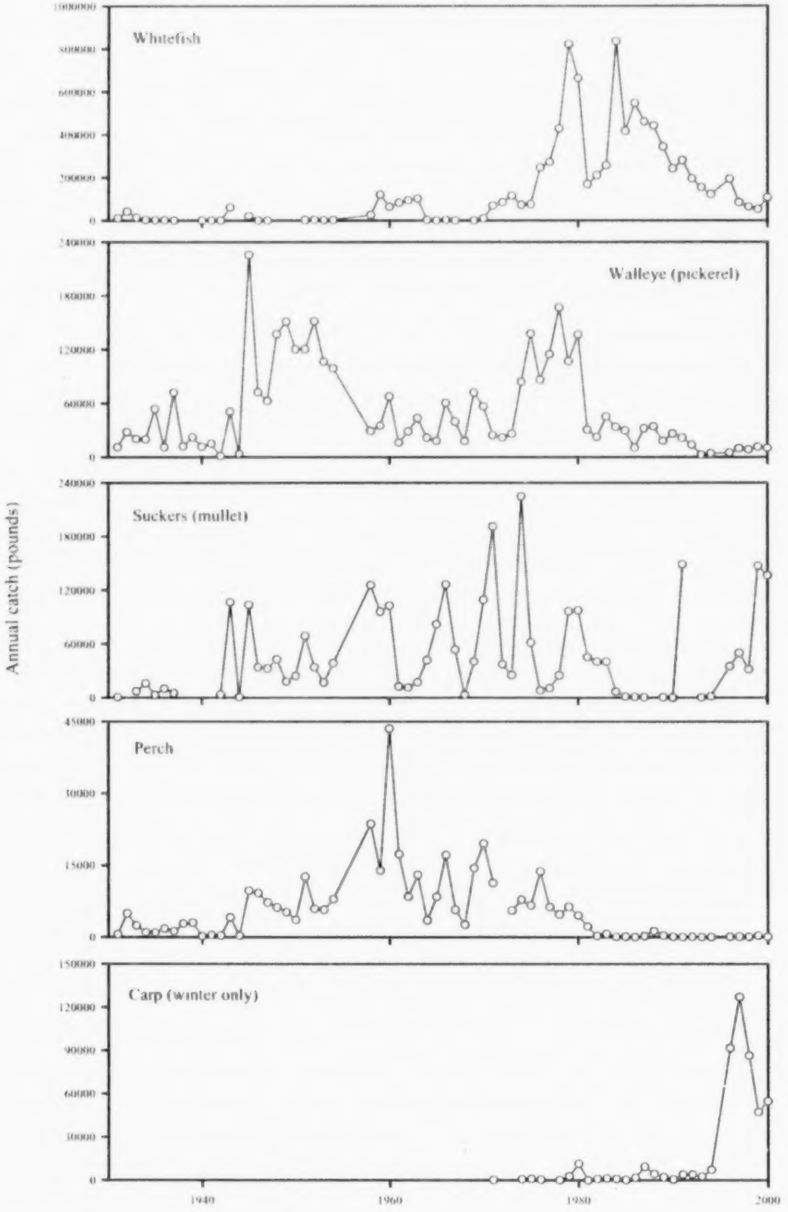
6.3.5 Lake St. Martin/Dauphin River

It is acknowledged that Lake St. Martin and the Dauphin River are important whitefish spawning grounds. First Nations representatives expressed concern about the effect of fluctuation in the water level of Lake St. Martin on the fishery of that lake. They also described the negative effects of widely varying flows on the fall spawning run of whitefish up the Dauphin River from Lake Winnipeg to spawning beds along the river and in Lake St. Martin. The annual yield of whitefish, walleye, mullet, perch and carp (winter only) on Lake St. Martin is shown in Figure 6.6.

Low water levels create problems with the whitefish and walleye fishery, partly due to low dissolved oxygen content in the water. It was also pointed out that fish often become trapped between frozen sections of the river when flows are too low. These fish usually perish because of inadequate oxygen in the stagnant water, or when the river freezes to the bottom. Low water also makes it inconvenient and sometimes difficult to launch boats.

The First Nations blame the FRWCS as well as unnaturally low water levels in the Dauphin River in the fall and winter for preventing the natural migration of fish and damaging their fishery. This is particularly the case with the whitefish spawning migration along the Dauphin River and in Lake St. Martin.

Figure 6.6: Lake St. Martin Commercial Fishery by Species, 1931 – 2000
(Prepared by the Committee)



The Dauphin River First Nation has different concerns related to fluctuating flows and water levels on the Dauphin River and the related effect on the fishery. The community also experiences difficulty with access to various parts of their community. This latter concern is outside the scope of this study.

Information from the Manitoba Conservation Fisheries Branch and local fishers indicates that for successful spawning and a successful Lake St. Martin fishery, the level of Lake St. Martin must be kept at an elevation no lower than 797.0 ft asl, preferably 799.0 ft asl. Below 797.0 ft asl, fishing nets tend to freeze in.

In addition, correspondence from the Fisheries Branch to the Water Resources Branch and to the Deputy Minister of Natural Resources in 1981[32] recommended a minimum flow of 1,000 cfs through the FRWCS over the fall period in order to maximize the fall whitefish spawning run, and over the winter/early spring period as well. This agrees with the suggestion of a First Nations member at the public meeting in St. Martin who recommended a flow of 1,100 cfs.

6.3.6 Delta Marsh and the Fishery

A report by Dr. Dale Wrubleski of Ducks Unlimited on the fishery in Delta Marsh outlines the importance of marshes in providing habitat for fish. In his presentation, he recommended that Lake Manitoba be regulated over a wider range of 810.0 ft asl to 813.0 ft asl in order to restore the health of the marshes and thus the provision of fish habitat.

6.3.7 Discussion

With respect to the question before the Committee of Lake Manitoba regulation, evidence presented by the Lake Manitoba Commercial Fishing Association, individual fishers and Manitoba Fisheries Branch indicates that the catch on Lake Manitoba is not directly related to water levels. High lake levels – in excess of 812.5 ft asl – allow fish to spawn farther upstream along streams and creeks with the result that fry may be trapped in small ponds when the water level recedes.

There is no agreement regarding the decline of the walleye fishery over the last 40 years or so. Commercial fishers blame the FRWCS and the reduction in water quality as a result of the Portage Diversion. The Fisheries Branch attributes any reduction to factors such as over-fishing in some years and lack of fishing effort in others.

The presence of large numbers of cormorants on Lake Manitoba is causing concern to the commercial fishing industry. Cormorants consume fish fry and are blamed, in part, by the industry for declining fish populations. Woods Creek Cottagers blamed low water levels in their area (northwestern portion of the lake) for an increase in cormorant habitat, and a corresponding increase in cormorant populations. However, Fisheries Branch staff disagree that cormorants have a negative impact on the walleye and sauger fishery, indicating that walleye and sauger fry do not comprise a significant portion of the cormorant diet.

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[32] Memo from Worth Hayden, Director of Fisheries to T.E. Weber, Director of the Water Resources Branch, August 6, 1981. Memo from Worth Hayden, Director of Fisheries to J.D. McNairney, Deputy Minister of Natural Resources, September 14, 1981.

6.4 Marshlands and Wildlife

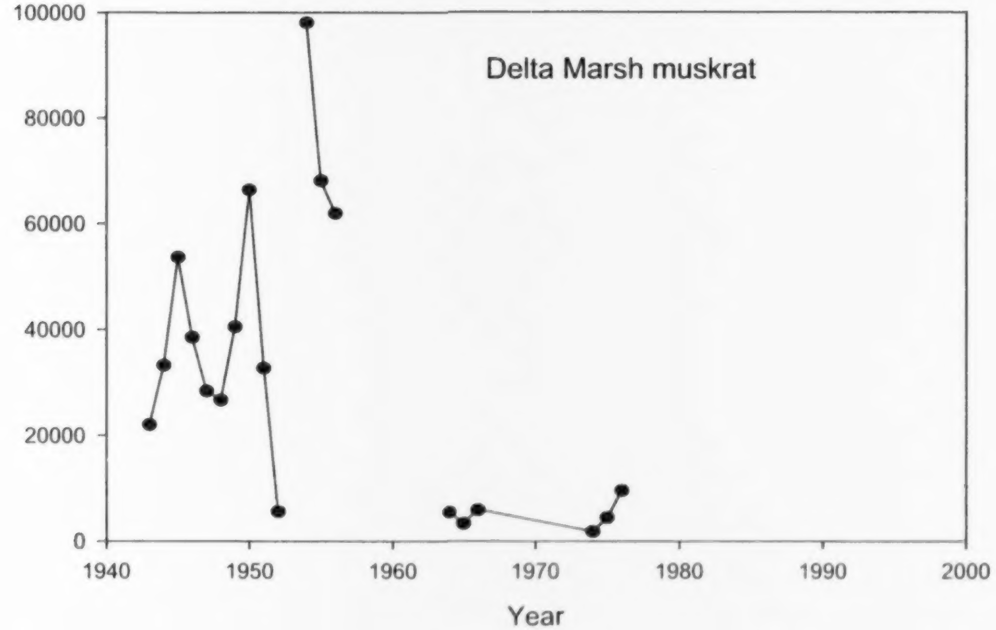
6.4.1 Introduction

There are an estimated 236,700 hectares (ha.) of marshland in the area surrounding Lake Manitoba, Pineimuta Lake and Lake St. Martin (Ron Coley, in his presentation to the Committee). Of those, more than 121,400 ha. around Lake Manitoba (D.U., referencing Canada Land Inventory) are considered to have high to moderate capability for waterfowl production. These wetlands have long been valuable to waterfowl as breeding, moulting and migration staging areas, as habitat for songbirds, shorebirds and colonial water birds and as spawning and nursery areas for fish.

These marshlands have also historically been important for the production of furbearers such as mink and muskrat, which had supported traditional wild fur trapping activity. Many consider muskrats a useful indicator of overall marsh degradation in that their abundance correlates directly to the quality of the marsh.

Committee member and Director of the University of Manitoba's Delta Marsh Field Station Dr. Gordon Goldsborough provided the Committee with information concerning muskrat populations in Delta Marsh. He compiled all Delta Marsh muskrat production data available to him for the period 1943 – 1976 (Figure 6.7), based on lodge counts by the provincial government. The low value in 1952 was attributed to a disease outbreak.

Figure 6.7: Delta Marsh Muskrat Populations
(prepared by the Committee)



Muskrat population estimates were made by the Manitoba Government in 1943 and intermittently until 1976. No similar measurements have been made since 1976. However, field observations in the late 1990s of few muskrats anywhere in the marsh by scientists of the Delta Marsh Field Station (University of Manitoba) place the population at near zero.

The data reveal a precipitous decrease in estimated muskrat populations in the marsh between the mid-1950s and the mid-1960s. Dr. Goldsborough indicates that in the years they (University of Manitoba staff and students) have been working at the marsh, they have seen virtually no muskrats, as compared to the tens of thousands reported in the 1950s. He says something has happened to cause the muskrat populations to crash and remain low for the past three decades.

In addition to a number of presentations by marshlands and wildlife interests at the public meetings, the Committee also heard formal presentations from the Delta Marsh Field Station and Manitoba Conservation Wildlife and Ecosystem Protection Branch. The consensus among those appearing before the Committee was the health and productivity of the marshes have declined in recent decades, and in particular since the introduction of lake level regulation in 1961.

6.4.2 Public Meetings

The Committee heard many presenters claim that waterfowl, furbearer and fish production has been greatly reduced in lakeside marshes in recent decades. Fall waterfowl numbers in the shoreline marshes in the south basin have declined drastically. Specifically, duck species such as lesser scaup and canvasbacks have declined in population in Delta Marsh since 1965. This decline has had a negative impact on hunting and tourism.

The decline of the quality of wetlands habitat is being blamed on carp activities, water level stabilization, infilling, diking and drainage. These factors have combined to create a loss of emergent and submergent vegetation, increased turbidity of the water in the marshes, murky bottoms, siltation and an invasion of hybrid cattails.

Since the Portage Diversion is viewed by many as a source of siltation, particularly in Delta Marsh, it was suggested the Diversion should only be operated when absolutely necessary and should be managed in such a way as to avoid spillover from the channel into Delta Marsh.

At the public meeting in Portage la Prairie, Ducks Unlimited Canada raised the question of managing the lakeshore marshes independently of Lake Manitoba. They have managed Lynchs Point, Marshy Point (East Meadows Ranch) and Sioux Pass by diking to exclude the impacts of Lake Manitoba regulation. Carp are excluded from all three marshes.

Lynchs Point and Marshy Point water levels are controlled by pumping to simulate seasonal and long-term fluctuations. Waterfowl and furbearers thrive, the water is clearer and submergent plant growth is abundant and healthy. Sioux Pass water levels are dependent on local runoff, and do not exhibit the same degree of fluctuation. Water in Sioux Pass is also clearer than Lake Manitoba. While submergent plant growth and wildlife populations are not as healthy as in Lynchs Point and Marshy Point, they are still better than the area immediately outside the marsh.

However, Ducks Unlimited pointed out that the cost of this approach, at an estimated $500 to $1000 per acre of marsh, is a factor. In addition, marsh access by desirable fish species and the restriction of human access are concerns. As an alternative to managing marshes independently, Ducks Unlimited suggested regulating Lake Manitoba to more closely follow natural historic ranges and durations of water levels.

Excluding carp from the marshes through the use of screens would also exclude other important fish species in the process. Instead, one presenter suggested that an increase in the harvest and exploitation of the abundant carp populations in the marsh, an under-utilized resource, should be examined.

Some presenters suggested a need for a large area sustainable development plan for the Lake Manitoba Basin and that the Province identify and sanction a lead agency to develop this plan. The strategy should develop consensus-based objectives and monitor outcomes to enhance future decisions, continuing the approach over the long term. More research is required to develop an effective management scheme and to allow for informed decisions when determining the optimum degree of lake level management.

6.4.3 Delta Marsh Field Station Presentation Summary – Dr. Gordon Goldsborough

Delta Marsh, located at the south end of Lake Manitoba, is a coastal wetland formed by erosion of sediments deposited at the mouth of the Assiniboine River when it discharged into Lake Manitoba several thousand years ago. It has been designated as a "Wetland of International Significance", a "Heritage Marsh" and an "Important Bird Area".

The benefits of coastal wetlands such as Delta Marsh include hay production, breeding and feeding habitat for lake fish, and breeding, migration and staging areas for waterfowl. They also act as natural filters, improving the quality of the water that passes through them before it reaches the lake.

The health of coastal wetlands depends in large part on fluctuating water levels. The operation of the FRWCS to control water levels on Lake Manitoba has removed the extreme highs and lows, and as a result has had negative impacts on Delta Marsh, and other coastal wetlands along the Lake Manitoba shoreline. Over the years, hybrid cattails have encroached into shallow areas of the marsh, reducing the amount of habitat for breeding waterfowl and other marsh fauna.

Carp were first seen in Delta Marsh in the late 1940s or early 1950s. In 1999, surveys revealed that at least 46 per cent of the biomass of the fish community in the marsh was carp. Carp uproot aquatic vegetation and stir up bottom sediments, adding to the turbidity of the water and destroying desirable plants.

Other changes in the marsh include the erosion of plant islands ("tules") and an increase in the murkiness of the water. There has also been an increase in algae in the marsh water, some of which produce potent toxins capable of killing humans, domestic animals and pets. This algae is suspected to be a product of increased nutrients from farmland entering the lake through the Portage Diversion, and sewage leachate from residences in the vicinity.

Lake Manitoba shoreline erosion has accelerated, in part, due to the loss of shoreline vegetation. This has come about as a result of stable lake levels and shoreline development activities, such as mowing and tilling of "weedy" vegetation by cottagers.

Delta Marsh could be improved by independently regulating water levels in the marsh by using dikes and control structures. Such structures have been proposed intermittently since at least the 1960s. Carp exclusion fences could be installed on all entrances to the marsh. However, these actions would be impractical because 1) they would require an ongoing, large commitment of resources to maintain, and 2) they would provide no benefit for numerous other marshes around the shores of Lake Manitoba which have probably been affected as severely as Delta Marsh.

A more efficient way to restore the marsh to a more healthy condition would be to de-regulate Lake Manitoba, allowing the natural long-term fluctuations in water levels to return.

6.4.4 Manitoba Conservation, Wildlife & Ecosystem Protection - Summary

The Branch's presentation focused on rare and endangered wildlife and historical data related to furbearer trapping in the south basin of Lake Manitoba. A suggested water level management regime that would optimize benefits to wildlife while avoiding the adverse effects of excessive drought or flooding was also offered.

The wildlife species presently of greatest concern is the endangered piping plover. There are believed to be no more than 2,700 piping plovers in existence, with only 27 adults observed in Manitoba in 2002. Of these, there were four nesting pairs on the beach near the entrance to Clandeboye Bay and one pair at Twin Lakes Beach in the Lake Francis Wildlife Management Area. Other potential nesting sites on Lake Manitoba include Hollywood Beach, Delta Beach, and the beach at the University of Manitoba Delta Marsh Field Station.

Piping plovers require wide beach areas comprised of sand and fine gravel for nesting. High water years, while they are not conducive to nesting by piping plovers, are necessary to control the encroachment of vegetation on the beach. There were no piping plovers attempting to nest near Lake Manitoba in 2001 when water levels were unusually high, but they quickly responded to the low water levels experienced in 2002.

Islands in Lake Manitoba, particularly to the south of The Narrows, are used as nesting colonies by American white pelicans. Listed as vulnerable in the 1980s, populations have recovered to such an extent that they are no longer considered vulnerable to extinction. Pelicans appear to have been little affected by the management of water levels in Lake Manitoba over the past forty years. Their recovery was likely aided by the greater abundance of coarse fish throughout their range.

Western grebe populations have declined in the Lake Manitoba Basin. Western grebes nest in emergent vegetation, preferring dense beds of hardstem bulrush, and these islands of emergent vegetation have disappeared in the marshes of the Lake Manitoba basin. Eared grebes, which are abundant elsewhere, have similar habitat requirements to western grebes and have declined in the Lake Manitoba basin while they have continued to thrive in suitable habitat elsewhere.

The beach ridge along the southern shore of Lake Manitoba is one of only two places in Manitoba where the locally rare hackberry tree occurs. These trees occur in low numbers on the beach ridge and appear to be unaffected by the current water level regime. However, excessively high water levels combined with severe storm action could pose a threat to them.

Manitoba Conservation has not monitored furbearer abundance directly, and trapper effort in recent decades is often more closely correlated with fur prices than with availability of furbearers. In 2001-2002, there were 36 trappers in the Delta Marsh area, with an average production of 54 muskrats per trapper. This compares with 1986-87 when there were 64 trappers harvesting an average of 123 muskrats per trapper.

Observations on furbearer abundance can only be drawn from anecdotal information and incidental observations by departmental staff. It appears that muskrat populations in particular are dramatically lower than they have historically been, even as recently as the mid-1980s. This reflects the decline in the abundance of emergent and submerged vegetation in Lake Manitoba's marshes.

The Branch proposed a water level management regime which could be applied to Lake Manitoba to mimic the natural flood and drought cycle. The 10-year management cycle would begin in year one with draw-down to 810.0 ft asl. Over the following years, the marsh would be refilled and water levels held, but using seasonal variations, and finally bringing the water to flood stage (813.5 ft asl) before repeating the cycle. This approach avoids the need to micro-manage marshes in the basin by isolating them, which may adversely impact fish, and require an enormous capital investment.

Draw-down allows organic matter to decompose and the exposure of the beach for shorebird nesting. Re-flooding encourages the re-colonization of submerged and emergent vegetation. A long-term variation in water levels between the draw-down and flooding stages should be no less than three feet to prevent hybrid cattail from taking over shallower basins. A seasonal draw-down of a few inches by late August is desirable to provide feeding areas for shorebirds and loafing areas for waterfowl.

6.4.5 Discussion

Of all the presentations made to the committee by wildlife and marshlands interests, the common concern expressed was the current regulation of Lake Manitoba levels within a narrow range. They claim this has had a negative impact on the shoreline marshes and consequently, the fish and wildlife resources that rely on the marshes for existence.

All wildlife and marshlands proponents agree that the best way to restore the marshes to their natural productivity is to allow annual and seasonal water levels on the lake to fluctuate naturally within a range other interest groups can accept. This would create wet and dry cycles within the marshes critical to their health. In conjunction with water level variation, it was also suggested by several presenters that the natural channels between the lake and shoreline marshes, which have been dammed or otherwise obstructed over time, should be re-opened, where necessary, to allow a natural transfer of water between the water bodies.

While lake levels historically fluctuated as much as six feet over the long term (about 810.0 ft to 816.0 ft asl), most presenters agreed that a return to that amount of fluctuation would be impractical. However, a range of fluctuation of three feet would be acceptable.

Generally, the consensus of wildlife concerns was that lake levels should fluctuate naturally over the long term between 810.0 ft asl and 813.0 or 813.5 ft asl. The lake should be allowed to follow natural changes within that range, then the FRWCS could be used to control water levels outside of that range. Seasonally, water levels should be allowed to rise to about 813.0 ft asl in the spring, then gradually drop over the summer to a low of about 811.5 in the fall.

There was overall agreement that the lake may exceed 813.0 ft asl on occasion or drop below 811.0, but that periodic, short-term "bursts" of higher or lower water levels would be acceptable, and in fact, may be beneficial to the marshes.

6.5 First Nations

6.5.1 Introduction

There are five First Nations directly bordering Lake Manitoba – Sandy Bay, Ebb and Flow, O-Chi-Chak-Ko-Sipi (Crane River), Lake Manitoba (Dog Creek) and Pinaymootang (Fairford). Another three First Nations communities are located downstream of the outlet of the lake into the Fairford River – Little Saskatchewan and Lake St. Martin (The Narrows), both bordering Lake St. Martin, and Dauphin River First Nation, which is located on Lake Winnipeg at the mouth of the Dauphin River.

The Pinaymootang First Nation straddles an area from Lake Manitoba in the west eastward to Lake Pineimuta and Lake St. Martin. The Pinaymootang, Lake St. Martin and Dauphin River First Nations all participated actively in this study through the public meeting process as well as by way of follow up meetings with the Committee. Their participation in the study was both welcomed and very helpful to the Committee.

There is a pending court case between the First Nations communities in the Lake St. Martin/Fairford River area and the Government of Canada related to flooding issues. Accordingly, some First Nations representatives were reluctant to appear before the Lake Manitoba Regulation Review Advisory Committee or to otherwise express their concerns related to the regulation of Lake Manitoba and its impacts. This has been reflected to some degree in the amount of information presented in the following sections.

6.5.2 Public meetings

Mr. Mark Traverse of the Lake St. Martin First Nation suggested the flow released through the FRWCS during the winter should be held at 1,100 cfs. This, in his opinion, provides the perfect amount of water for the winter fishery, especially the north end of Lake St. Martin. At lower flows, fishermen have problems with nets freezing into the ice.

Mr. Traverse pointed out that when Lake St. Martin reaches high levels in September, the muskrats build their houses accordingly. When water levels drop in October, the muskrats become frozen out, and set out to seek new homes, or die in the stranded ones.

The Pinaymootang First Nation (Fairford) claimed that constructing a dam on the Fairford River has flooded about one-half of the reserve. Also, the operation of the FRWCS does not mimic natural conditions, resulting in unpredictable periods of flooding and drought.

Water quality is a major concern to the First Nation community. During high water the water table rises, or the land is flooded directly, saturating the soil and with it, septic tanks and water wells. A 1989 study conducted by Wardrop Engineering concluded that private wells throughout the community are contaminated and not suitable for drinking. The Pinaymootang First Nation asked that the operation of the FRWCS be examined, and that First Nations be a part of the decision-making process.

Myrle Traverse pointed out water level fluctuation downstream of the FRWCS has resulted in much of the land bordering Pineimuta Lake and Lake St. Martin becoming permanent swamp. Hunting, trapping and farming has been negatively impacted, as have roads and recreational facilities. The FRWCS has had a negative impact on the movement of fish.

Mould produced as a result of the wet conditions is a health hazard to people in the community. The local drinking water cannot be consumed; bottled water must be used. Access to traditional foods has been cut off.

The First Nations communities in the area advocate a natural lake level regime – that lake levels should not be artificially altered. However, given the circumstances, the Province should seek First Nations permission to release water from Lake Manitoba.

6.5.3 Impact of Fluctuating Water Levels

Issues related to the commercial fishery on Lake St. Martin and the Dauphin River are discussed in Section 6.3.5: Lake St. Martin/Dauphin River

Pinaymootang First Nation expressed concern regarding the variation in lake levels since construction of the FRWCS. During periods of high Lake Manitoba water levels and the resulting high flows in the Fairford River, Lake St. Martin rises to levels higher than if there were no regulation. During low water levels on Lake Manitoba, flows on the Fairford are scaled back resulting in abnormally low levels on Lake St. Martin. Thus the area downstream of the outlet of Lake Manitoba has, since the construction of the FRWCS in 1961, been subject to wide variations in water levels.

High water levels cause flooding in the Pinaymootang and Lake St. Martin First Nation communities around Lake St. Martin. The First Nations have poorly functioning septic systems and contaminated wells and blame these conditions on the abnormally high water levels.

Information acquired by the Committee from Indian and Northern Affairs Canada indicates that the Federal government has incurred costs of approximately $20 million over the past ten years for short-term flood control and associated activities. This investment has been ineffective in providing a long-term solution to the flooding problem around Lake St. Martin.

Big Rock Camp, a tourist camp on Lake St. Martin, as well as other camps along the Dauphin River expressed concerns regarding low water levels. Low water levels have negative impacts on access for boating, which in turn has a negative effect on the economic viability of these camps.

The First Nations stated to the Committee that there are few, if any, cattle raised on their lands any more due to the loss of haylands as a result of flooding. As reported in the 1978 Manitoba Water Commission report, the change in water level regime led the province to undertake a program to either purchase the lands affected outright or to improve and transfer certain lands to the First Nations as compensation for the loss of hay production in areas now prone to flooding.

The change in water level regime has also had a negative effect on the health of the marshes and indigenous wildlife in the area. Fluctuating water levels, particularly in the fall and winter, result in muskrats being frozen out and dying. First Nation members report that while the area once had abundant populations of furbearers such as muskrat and mink, little trapping is carried out now.

Changing flows and water levels during the winter leads to the formation of frazzle ice along the rivers. An increase in water levels on Lake St. Martin can cause the ice to rise and the formation of unsafe slush ice along the shore.

Modeling conducted in the Fairford River/Lake St. Martin area by UMA Engineering for Indian and Northern Affairs Canada has demonstrated that compared to natural conditions:

- There is a greater frequency of both high and low water levels.
- Fairford River peak flows have approximately doubled.
- The maximum Pineimuta Lake level was over two feet higher than under natural conditions.
- The maximum annual range of Pineimuta Lake levels has increased by approximately three-fold.
- The maximum Lake St. Martin level was over two feet higher than under natural conditions.
- Water levels less than 797.0 ft asl on Lake St. Martin occur about twice as often as they would under natural conditions.
- The long-term range of Lake St. Martin water levels as well as the maximum annual range have both increased significantly.
- With the present operation of the FRWCS, Lake St. Martin levels can be expected to exceed the estimated shoreline elevation of 800.0 ft asl significantly more often than under natural conditions.

The modeling also indicates that, since 1960, there have been numerous annual peak water levels on Lake St. Martin that exceeded elevation 800.0 ft asl, the approximate level when flooding occurs. Many of these events exceeded this level by one foot or more and a few by approximately three feet. This compares to calculated natural conditions under which only a few events would have exceeded 800.0 ft. asl.

The increased variability in water levels is even greater on Pinemuta Lake than on Lake St. Martin. This has had an adverse effect on wildlife habitat.

There is no artificial control on the flow of water from Lake St. Martin into the Dauphin River and large variations in outflow from Lake Manitoba thus affects the Dauphin River.

6.5.4 Summary

During its visits to the area, the Committee has observed the claims and concerns expressed by the First Nations in the Lake St. Martin area. As a result of these tours, and discussions with the First Nations, it appears that a water level range on Lake St. Martin of 797.0 ft asl to 800.0 ft asl would be ideal for the people of the area. This range would also fit well with the fishery. As discussed in Section 6.3.5, the Fisheries Branch indicates that a level of 799.0 ft asl is optimum for the Lake St. Martin fishery and that below a level of 797.0 ft asl fishermen begin to have difficulty with their nets becoming frozen into the ice.

In a 1978 study which examined the regulation of Lake Manitoba and the alternate periods of flooding and low water levels on downstream interests, the Manitoba Water Commission examined nine alternative schemes for stabilizing downstream water levels and flows. These are listed below:

- Lake St. Martin dam and dyke
- Lake St. Martin dam and auxiliary outlet
- Lake St. Martin dam and Dauphin River channelization
- Lower Fairford River channel improvements
- Lower Fairford River channel improvements and diversion
- Diversion from Pineimuta Lake to Lake St. Martin
- Channel improvements, diversion, dyking and pumping between the Fairford Dam and Lake St. Martin
- Diversion from Pineimuta Lake to Lake St. Martin and various dyking along the Fairford River
- Dyking with two-way control structure – Fairford River, Pineimuta Lake

In the opinion of many interested parties, several of these options, as well as others, should be re-examined.

7.0 Findings

The Lake Manitoba Regulation Review Advisory Committee is the most recent government-appointed group to examine the regulation of Lake Manitoba and the impact on the land and water courses downstream of the Fairford River Water Control Structure. Through its investigations, consultations and deliberations, the Committee has become aware of a number of facts or findings related to Lake Manitoba and areas downstream.

7.1 Lake Manitoba

7.1.1 Water Levels

a) Attempts have been made since the late 1800s to control the level of Lake Manitoba. These attempts have been in response to events such as high lake levels in the early 1880s, low levels in the 1930s and high water levels again in the mid-1950s.

b) The majority of overland flow into Lake Manitoba is from Lake Winnipegosis through the Waterhen River. During the period 1972 to 2001, the average annual contribution of the Waterhen River to Lake Manitoba volumes was 1.9 million acre-feet (ac-ft). The Whitemud River and local overland flows combined, excluding the Portage Diversion, averaged 257,000 ac-ft. Precipitation contributes about 1.8 million ac-ft directly to Lake Manitoba annually.

c) The Portage Diversion has been operated 23 times since its completion in 1970. The largest contribution of water to Lake Manitoba by the Portage Diversion occurred in 1976, when 1,420,000 ac-ft entered the lake through the Diversion. This would have amounted to an increase in the lake level of 1.22 ft, assuming the Fairford River Water Control Structure had not been in operation. However, the net impact has been estimated to be the addition of about 10 inches to the lake level.

Over the 33 years since it opened, the Diversion has contributed an average annual volume of 246,774 ac-ft to Lake Manitoba. This amount of water would equate to 2.6 inches in lake water level.

The Province has recently undertaken structural modifications to the Diversion to reduce any negative impacts that might occur as a result of using it as an irrigation supply channel.

d) The Fairford River is the only outlet from Lake Manitoba. The average annual discharge through the Fairford River (1972 to 2001) was about 2.0 million ac-ft. Water also leaves Lake Manitoba through evaporation, also averaging about 2.0 million ac-ft per year.

e) The Fairford River Water Control Structure, completed in 1961, was designed to regulate both high and low water levels on Lake Manitoba. Since that date, the lake has been regulated to a target level of 812.17 feet above sea level (ft asl), the long-term average level of the lake with a target range of 810.87 ft asl to 812.87 ft asl.

f) Lake Manitoba level records prior to 1961 may not precisely reflect natural conditions since lake level management efforts began with channel improvements to the Fairford River during the period 1899 to 1901, and the completion of a concrete control structure in December 1933.

g) According to water level records (record-keeping began in 1913), the long-term variability of water levels on Lake Manitoba has decreased since construction of the Fairford River Water Control Structure, while water level variations within the year have increased slightly. The long-term variability since regulation is 3.12 ft as compared to 6.33 ft prior to regulation.

h) Modeling carried out by the Water Branch of Manitoba Conservation (Appendix D: Minimal Log Change Model) indicates that, with relatively minor changes in the operation of the Fairford River Water Control Structure, the lake can be maintained for the most part, within a range of 810.5 to 812.5 ft asl, with the expectation levels will rise to 813.0 and drop to 810.0 ft asl in some years. Downstream problems with respect to low water levels as well as flooding should be mitigated at the same time.

7.1.2 Cottage Owners

a) Erosion damage in 1999 at Twin Lakes Beach has been estimated, by lakeshore property owners in the area, at approximately $1,000,000 to cottages, shoreline protection structures, outbuildings and other structures. While this figure has not been independently verified, it is recognized that substantial windstorm-related erosion damage has occurred to shoreline properties generally, and particularly in the southeast portion of the south basin.

b) Lake Manitoba cottagers are divided in their opinions as to the ideal lake level. Those located in southern-most portion of the south basin – Twin Lakes Beach and Delta Beach – want lower levels, ideally 811.5 ft asl, to reduce property damage from erosion and to provide wider beaches. Cottagers and other recreational interests located in the south basin, north of Twin Lakes Beach, as well as those located in the north basin prefer higher water levels (812.0 ft asl or higher) to provide better access for watercraft and to reduce weed growth.

7.1.3 Shoreline Dynamics

a) The shorelines along the south basin of Lake Manitoba are primarily granular in composition. On granular shorelines, the shoreline can migrate both onshore and offshore in response to a change in water level or wave conditions. Any erosion or accretion is recoverable.

b) Conversely, cohesive shorelines – those made up of non-granular material such as clay or glacial till – do not accrete, they only erode. Cohesive shorelines may be characterized by low to steep bluffs along the beach. If the water level increases on a cohesive shoreline, erosion will occur by down-cutting of the foreshore or by undercutting shoreline bluffs. There will be a general, irreversible loss of the beach.

7.1.4 Fisheries

a) While the success of the commercial fishery in Lake Manitoba is not necessarily directly related to water levels, high water can strand fry in pools in streams flowing into the lake when lake water levels drop in late spring.

b) The predominate marketable fish species caught by commercial fishers on Lake Manitoba has changed from whitefish in the late 1800s to pickerel, sauger and perch today. The reason for this change is unclear to the Committee. There has been a large increase in rough fish such as mullet and carp present in the catch. Tulibee catch remains high, although it is not considered a commercial species at this time.

c) The total recorded catch of the commercial winter fishery on Lake Manitoba has decreased from more than six to eight million kilograms per year in the late 1940s to less than two million kilograms in 2002. There are widely varying opinions between commercial fishers and Manitoba Conservation's Fisheries Branch regarding the cause of this decline. The Committee is not in a position to determine the reasons for the decline.

d) Commercial fishers on Lake Manitoba blame the Fairford River Water Control Structure for negatively affecting the passage of fish and thus, the fishery on Lake Manitoba.

e) The Committee is not aware of an environmental impact study being conducted prior to the construction of the Fairford River Water Control Structure in 1961. It should be noted that such an assessment was not a requirement of Provincial regulations or legislation of the day.

f) Experts with the Department of Fisheries and Oceans, Freshwater Institute in Winnipeg maintain that the design of the fish ladder at the Fairford River Water Control Structure is a state-of-the-art structure. This does not necessarily mean that the same number of fish pass through the structure to Lake Manitoba as did prior to construction of the structure, but simply that the present fish ladder, properly operated and maintained, is the most effective fish passage structure available.

g) To the knowledge of the Committee, there are no operation and maintenance records for the fish ladder in the Fairford River Water Control Structure. There is concern that the fish ladder is not being operated and maintained according to its original design.

7.1.5 Ranching

a) Ranchers generally prefer lower lake water levels, at or near the current target level of 812.17 ft asl in the spring, dropping to a level of 811.0 to 811.5 by late June to allow access to native haylands along the lakeshore. At the same time, ranchers acknowledge that periodic flooding is good for the land and the native grasses in the marshes surrounding the lake.

7.1.6 Wetlands

a) There are an estimated 236,700 hectares of marshland in the area surrounding Lake Manitoba, Lake St. Martin and Pineimuta Lake. Historically, these wetlands have been valuable to waterfowl as breeding, moulting and migration staging areas, for furbearers such as mink and muskrat and as spawning and nursery areas for fish. In addition, marshlands provide important habitat for songbirds, shorebirds and colonial water birds.

b) The productivity and biodiversity of the coastal marshlands bordering, and connected to Lake Manitoba (including Delta Marsh, officially designated as a "Wetland of International Significance" and a "Heritage Marsh") have deteriorated significantly since lake level regulation began in 1961.

c) Delta Marsh has undergone several marked changes since the 1960s. These include decreases in the area of shallow open water, increases in the amount of suspended sediment, decreases in submerged plants, disappearance of emergent plants that dampen the erosional force of wind and waves, proliferation of hybrid cattail and dramatic declines in waterfowl and muskrat populations. These changes are thought to have arisen due to the smaller range of water levels in the marsh due to regulation of Lake Manitoba, and invasion of the marsh by common carp, an introduced fish species.

d) There is consensus among interests concerned with these marshes that larger variations in water levels over the long term than those experienced since lake level regulation began, are required for the health of the marshes and associated wildlife. Water level fluctuations should be nearer to those that occurred under natural conditions prior to regulation – generally a three-foot fluctuation over time, while considerably less than natural, was considered acceptable.

7.1.7 Water Quality

a) Water quality in Lake Manitoba generally falls within the "fair" to "good" regulatory classes, although values for such parameters as total phosphorus and conductivity often exceed values desirable for drinking water, irrigation, or protection of aquatic life.

b) There is wide-spread concern over the operation of the Portage Diversion and its impact on water levels and water quality of Lake Manitoba. However, many of these concerns appear to be based on perceptions rather than factual evidence.

c) There is also concern with respect to the debris that enters the lake through the Diversion and gathers on Delta Beach, as well as the maintenance of the Diversion itself. Many presenters requested that the use of the Diversion be limited to as short a time period as possible.

d) Provincial government calculations indicate that during the years in which it is operated, the Portage Diversion can comprise over half the total phosphorus inputs to Lake Manitoba. While this may threaten lake water quality, the basis of these calculations is not clear and more data analysis may be required. Consequently, the Committee cannot, at this time, fully evaluate the importance of the Portage Diversion as a source of nutrients, sediments, pesticides, debris, and other materials to Lake Manitoba.

e) Water quality in Lake Manitoba has been studied since at least 1928 but more intensively since the 1960s, and especially since 1991. Samples have been collected from over 20 sites in Lake Manitoba, some in the north basin but most in the south basin. The current monitoring program consists of monthly measurements at a single site in the south basin of Lake Manitoba, monthly sampling of the Assiniboine River upstream of the Portage Diversion, and monthly sampling of the Whitemud and Waterhen Rivers.

f) The Committee has not been able to ascertain if the present provincial government water quality monitoring infrastructure on Lake Manitoba is adequate for determining lake-wide trends in water quality.

g) Evaluation of inter-decadal water quality trends is difficult due to improvements over time in methods of measurement, collection of water samples at different sites around the lake at different times, and different lengths of time during which measurements were taken. Therefore, the Committee believes the only data on which it is valid to examine trends over time are those collected year-round at monthly intervals since 1991.

7.2 Downstream of the Fairford River Water Control Structure

7.2.1 Water Levels

a) The Fairford River Water Control Structure (FRWCS), operated since 1961, has the ability to permit both higher and lower outflows from Lake Manitoba than under natural conditions. The operation of this structure has drastically increased the variation in flows and water levels downstream.

b) Modeling conducted by UMA Engineering for Indian and Northern Affairs Canada has demonstrated that compared to natural conditions:

- Fairford River peak flows have approximately doubled.
- On both Pineimuta Lake and Lake St. Martin, maximum lake levels have increased significantly since the construction of the FRWCS.
- Water levels below 797.0 ft asl occur on Lake St. Martin about twice as often as they would under natural conditions.
- With the present operation of the FRWCS, water levels on Lake St. Martin can be expected to exceed 800.0 ft asl significantly more often than under natural conditions.

c) Since 1960, there have been numerous annual peak water levels on Lake St. Martin that exceeded elevation 800.0 ft asl, the approximate level when flooding occurs. Many of these events exceeded this level by more than one foot and a few by approximately three feet. Under calculated natural conditions, only a few events would have exceeded 800.0 ft asl.

d) The increased variability in water levels is even greater on Pineimuta Lake than on Lake St. Martin. This has had an adverse effect on wildlife habitat.

e) There is no artificial control on the flow of water from Lake St. Martin into the Dauphin River and large variations of outflow from Lake Manitoba also affects the Dauphin River.

7.2.2 Communities

a) First Nations on the Fairford, Little Saskatchewan and Narrows Reserves, downstream of the FRWCS are affected most with the variability of water levels. As the privately held land affected by flooding was purchased by Manitoba in the 1960s, the First Nations are the only rights holders with shoreline land. High water levels adversely affect many activities in these communities including direct flooding of low-lying homes.

b) Indian and Northern Affairs Canada indicates that the Federal government has incurred costs of approximately $20 million over the past ten years for short-term flood control and associated activities. This investment has been ineffective in providing a long-term solution to the flooding problem around Lake St. Martin.

c) Widely fluctuating flows through the FRWCS and associated changes in water levels on Lake St. Martin and Pineimuta Lake have resulted in impacts to economic and traditional activities including ranching, fishing and trapping.

7.2.3 Fisheries

a) Low water levels on Lake St. Martin create problems with the whitefish and walleye fishery, including the loss of fish in the winter due to low oxygen levels, and fish becoming trapped in pools in the Fairford and Dauphin rivers and being lost when the pools freeze to the bottom. Low water levels also create boating access problems for residents of the area during the open water season. Low flows in the Fairford and Dauphin rivers can inhibit the annual spawning run.

b) The fishery on Lake St. Martin requires lake levels of 797.0 ft asl or higher to be successful. According to Manitoba Conservation's Fisheries Branch and local fishers, the ideal level is about 799.0 ft asl. In addition, correspondence from the Director of Fisheries to the Deputy Minister on Natural Resources in 1981 indicated that minimum flows of 1000 cfs are also required on the Fairford River to permit successful spawning, particularly the fall whitefish spawn. Changing water levels on Lake St. Martin during the winter fishing season causes great difficulties for fishers such as nets freezing in the lake.

c) Low winter flows were also a contributing factor in the closing of the Dauphin River Fish Hatchery as low flows and dissolved oxygen resulted in several years when significant numbers of the fry in the hatchery perished.

7.2.4 Ranching

a) In the past, cattle ranching was an important part of the regional economy around Lake St. Martin, and remains so on land located within the RM of Grahamdale. This was based to a large degree on the harvest of the marsh meadows for the production of hay and forage. After the loss of several hay crops in the 1960s due to unexpected high flows late in the season, the provincial government bought all the patent land around the lake. The province was not able to purchase the land occupied by the three First Nations in this area.

b) Residents state that cattle ranching by the First Nations communities has declined during the regulated period to the point where it is no longer a significant activity.

7.2.5 Wetlands

a) There have been no recent studies of the wetlands surrounding Pineimuta Lake and Lake St. Martin. However, it has been brought to the attention of the Committee that the large increase in annual variation in water levels on these lakes has resulted in significant deterioration in the health of the marshlands and indigenous wildlife.

b) Ducks Unlimited indicated in their submission to the 1978 Manitoba Water Commission that the waterfowl production on Pineimuta Lake had fallen to four per cent of its potential capability and that muskrat populations were also severely affected by the operation of the FRWCS. For example, in the winter of 1975-76, 70 per cent of the muskrat lodges were flooded out in a 30-acre sample area.

c) The problems encountered downstream of the FRWCS are not the same as those in the marshes surrounding Lake Manitoba where stable water levels have affected habitat. On the downstream marshes, wide variations in water levels have reduced the ability of waterfowl and fur-bearing animals to survive and reproduce.

7.2.6 Water Quality

a) Limited information exists for water quality in the Fairford and Dauphin rivers. No water quality monitoring is currently conducted on Pineimuta Lake and Lake St. Martin.

b) The First Nations blame increased flooding of their lands for problems with potable water quality.

8.0 Recommendations

There is a clear consensus among the members of the LMRRAC that Lake Manitoba should be permitted to fluctuate in a manner more closely related to the natural condition. This will permit the rejuvenation of the world-class marshlands surrounding the lake and the associated wildlife population. At the same time, the wide fluctuation in flows and water levels which have been transferred to downstream water bodies and have created severe problems for First Nations and downstream wildlife, fisheries and tourist operators will be reduced. In addition, the members are acutely aware of what Lake Manitoba water levels are required to prevent the high cost of property damage to cottage developments at the south end of the lake, water levels necessary to maximize hay production as well as the fishery catch, as well as the preferred water levels of recreation interests around the lake.

The Committee has concluded that the best water level management regime for Lake Manitoba and downstream interests is one which would permit Lake Manitoba to fluctuate between 810.5 and 812.5 feet above sea level (ft asl), insofar as this may be reasonably possible, with the expectation that water levels on the lake may rise to 813.0 ft asl in some years and drop to 810.0 ft asl in others. A water level of 797.0 ft asl to 800.0 ft asl should be maintained on Lake St Martin insofar as that may reasonably possible. In addition, a minimum flow of 800 cfs should be maintained along the Dauphin River, with a desirable flow of 1,000 cfs, insofar as this may be reasonably possible.

In order to determine the feasibility of the recommended management regime, the Lake Manitoba Regulation Review Advisory Committee requested Manitoba Conservation's Water Branch to develop a model and to run a number of alternative scenarios for the operation of the FRWCS with respect to the management of Lake Manitoba and Lake St. Martin and the flows in the Fairford and Dauphin rivers. The Committee was also granted access to the modeling study carried out by UMA Engineering with respect to flooding of Lake St. Martin and found this study to be very helpful in gaining an understanding of downstream flooding and possible solutions.

Based on the modeling carried out by the Water Branch, the Committee is of the opinion that a water management regime can be developed and put into place which will permit the achievement of the above described regime. (See Minimal Log Change Model, Appendix D.) This regime would allow the level of Lake Manitoba to be brought to a level of 811.5 to 811.75 ft asl in the late summer or fall to accommodate the interests of ranchers and the erosion concerns of affected cottage owners. At the same time, the modeling indicates that the important downstream interests of the First Nations and fisheries can be accommodated.

The Committee recognizes that this regime may not satisfy all interests around Lake Manitoba all of the time. In particular, cottagers who want higher water, and who may have built their cottages and associated facilities based on a more constant lake level with a target of 812.17 ft asl, may not be satisfied with this regime. However, the Committee will recommend that the Water Branch work with these cottage owner associations to develop solutions to their recreational problems and concerns.

The Committee cautions that any water level management regime is subject to the vagaries of nature and that there will be years when the preferred water level management regime cannot be attained or maintained. This is particular to Lake Manitoba, given the fact the lake has a relatively low inflow and outflow compared to its size. The years 2002 and 2003 are good examples, when even with minimum outflows from the lake since the spring of 2002, Lake Manitoba is considerably lower then the current target level, as are the levels in Lake St. Martin and Lake Pineimuta. Also, the rejuvenation of the marshlands and wildlife is a long-term project which will take a number of years to accomplish.

Any water level management regime requires a certain amount of judgment as part of its implementation. The Committee is of the opinion that an ongoing Lake Manitoba Advisory Committee be established to advise government with respect to the management of Lake Manitoba and downstream interests and to monitor the success of the ongoing water management regime. It is important that this Committee have representation from all interests groups and sub-groups including full representation from the First Nations.

The Lake Manitoba Regulation Review Advisory Committee respectfully submits the following recommendations to the Manitoba Minister of Conservation.

1) Lake Manitoba should be managed in a more natural fashion based on the Minimal Log Change Model (Appendix D) developed for the Committee by the Manitoba Water Branch. Utilizing this model, or a refined version, the following operating rules for the Fairford River Water Control Structure (FRWCS) should be applied:

a) Water levels on Lake Manitoba should be permitted to fluctuate between 810.5 and 812.5 feet above sea level (ft asl) over a period of years, insofar as this may be reasonably possible, with the expectation that water levels on the lake may rise to 813.0 ft asl in some years and drop to 810.0 ft asl in others;

b) Any variance in the lake levels outside of the range shall be shared between Lake Manitoba and Lake St. Martin, insofar as this may be reasonably possible;

c) The level of Lake St. Martin should be maintained within a more natural range of 797.0 ft to 800.0 ft asl insofar as this may be reasonably possible, in order to reduce flooding, to provide better access for commercial fishing and recreational interests, to enhance the commercial and sport fisheries, to maintain marshlands in a natural state, to restore the natural aesthetics of the region and to provide for hayland for local ranchers;

d) The minimum flow in the Fairford River should be 800 cubic feet per second (cfs) with a desirable minimum flow of 1,000 cfs insofar as the achievement of both of these flows may be reasonably possible, and

e) An additional water level monitoring station should be installed on Lake St. Martin nearer the existing communities along the north shore.

2) Fairford River Water Control Structure (FRWCS) and Fish Ladder.

a) Operating and maintenance records for the FRWCS and the associated fish ladder should be maintained and made available to the public.

b) Monitoring the condition, and maintenance of, the FRWCS should be conducted on a regular basis.

c) The fish ladder associated with the FRWCS should be operated as per the original design and intent.

d) Maintenance of the FRWCS fish ladder should be carried out on a regular basis.

e) Consideration should be given, in consultation with the Lake Manitoba Commercial Fishing Association, Lake Manitoba Fish Enhancement Committees and Manitoba Conservation Fisheries officials, to the construction of additional fish ladders at such time as the FRWCS is reconstructed, or as deemed appropriate.

3) Public Initiatives

a) The Province should work with cottage owners, tourist operators, rural municipalities and First Nations to facilitate and enhance access to Lake Manitoba and Lake St. Martin for swimming and boating and to maintain or enhance the quality of the lakeshore for associated activities.

b) An information delivery system such as an Internet website should be developed to provide all stakeholders with historic lake level data and current lake level data on a real-time basis. The site could also provide information related to inflows and outflows including those through the FRWCS, water quality, Portage Diversion operation and other relevant information.

c) Man-made obstructions in outlets connecting marshlands to Lake Manitoba should be removed, where deemed advisable by wildlife experts, to permit the natural flushing action provided by the flow of water between the coastal marshes and their adjoining lakes.

4) In conjunction with the appropriate partners, the Province of Manitoba should carry out, or cause to be carried out, the studies itemized below. In so doing, due consideration should be given to the insight, Traditional Ecological Knowledge and oral evidence provided by First Nations people and others in regards to the history and management of the lands and resources in the area.

a) Initiate, in concert with the appropriate First Nations, studies to examine means to regulate the outflow of Lake St. Martin and/or Pineimuta Lake into the Dauphin River. The purpose of these studies would be to determine methods of mitigating extreme high and low water levels. Such studies should fully take into account all issues deemed relevant, including the environment, wildlife, fisheries, haylands, downstream and community impacts and social and economic issues.

b) A multi-year scientific study should be carried out to ascertain whether the proposed water level management regime for Lake Manitoba, Fairford River, and Lake St. Martin is successful at reversing the degradation of the lakeshores, coastal marshlands and beaches.

c) Studies should be carried out, in conjunction with the Lake Manitoba Fish Enhancement Committees, to better determine the ability of the current FRWCS fish ladder to pass fish, and to determine methods in which its effectiveness may be improved.

d) An investigation should be conducted into potential methods of reducing the amount of debris being produced and carried in the Portage Diversion channel into Lake Manitoba, and to determine more efficient methods of cleanup along the shore.

e) More thorough analysis of existing water quality data, focusing on trends from 1991 to present, should be carried out. All available sources of data, including remote sensing information from aerial photography and satellite imagery, should be used in this assessment.

f) Thorough mass balance calculations should be conducted to ascertain the relative contributions of the three major channels (Whitemud River, Waterhen River and Portage Diversion) on Lake Manitoba water quality. This may require more data than are presently available. If so, collection of such data should be a priority of a short-term, intensive monitoring program.

g) A critical evaluation of the present water quality monitoring infrastructure on Lake Manitoba and connected waterways should be conducted, with the objectives of determining: how many sites are needed to adequately assess lake-wide differences in water quality; how frequently samples should be collected; whether samples collected in the Assiniboine River are representative of water quality conditions in the Portage Diversion during periods of high flow; and whether Lake Manitoba water quality measurements adequately represent those in downstream areas, including the Fairford and Dauphin Rivers, and Pineimuta Lake and Lake St. Martin. This evaluation should involve an intensive water quality monitoring study, with samples collected at numerous sites at regular intervals over a period of at least two years.

5) Portage Diversion

a) The use of the Portage Diversion should be restricted to those periods of time and flows which are absolutely necessary to protect downstream interests along the Assiniboine River and in Winnipeg. The operating rules of the Portage Diversion should be re-examined, with the objective of asserting its primary function as a short-term flood protection work, and to minimizing its discharge of nutrients, sediments, debris, and other materials into Lake Manitoba.

b) Clean-up of debris deposited from the Portage Diversion onto Delta Beach and other affected areas each spring the Diversion is operated should be carried out in a timely fashion.

6) The Lake Manitoba Regulation Review Advisory Committee is of the opinion that the best decisions are reached when all those impacted are involved in the consensus-building process. In that regard, the Committee recommends the establishment of an on-going Lake Manitoba Advisory Committee with representation from all interest groups associated with the

Lake Manitoba basin, as well as interests downstream of the Fairford River Water Control Structure. This Committee should be financially supported by the Province of Manitoba and include representation from agriculture, fisheries, First Nations, cottage owners from both basins, other recreation interests, wildlife proponents and other rights holders as the Province deems appropriate.

The Committee's terms of reference should include, but not necessarily be limited to the following:

a) To establish and maintain an on-going dialogue with local interests, municipalities and the Province regarding the management of Lake Manitoba, Pineimuta Lake, Lake St. Martin and the Fairford and Dauphin rivers, to solicit, as required, public input related to these concerns, and to communicate with the public on a regular basis;

b) Communicate with the Minister on an on-going basis with regard to water levels on Lake Manitoba, Pineimuta Lake and Lake St. Martin, including the operation and maintenance of the Fairford River Water Control Structure and the associated fish ladder, and to recommend appropriate seasonal flows to be maintained in the Fairford and Dauphin rivers insofar as this is reasonably possible;

c) Advocate long-term monitoring and research on water levels and the health of Lake Manitoba, Pineimuta Lake and Lake St. Martin, including coastal marshlands along these water bodies, to be carried out by the appropriate agencies and report on the results annually to the Minister. This should include all aspects of water quality, fisheries, wildlife, agriculture, recreation, shoreline erosion, marshland rejuvenation, impacts on First Nations and other communities, and such other matters as deemed advisable by the Committee or by the Minister;

d) Investigate, and if considered advisable, recommend remedial projects to enhance all aspects of the general health of the lakes, associated marshlands and associated resources and resource uses, as outlined in section (c) above. In this regard, the Committee shall actively encourage jointly funded private sector/government projects;

e) To appoint a member of the Lake Manitoba Advisory Committee to the Portage Diversion Advisory Committee to ensure that Lake Manitoba interests are taken into consideration in the operation of the Diversion, and

f) To provide other guidance to the Minister as may be deemed appropriate.

g) To facilitate the work of the proposed Lake Manitoba Advisory Committee, all documents collected and commissioned by the Lake Manitoba Regulation Review Advisory Committee should be collected and maintained on file as a source of information and reference.

h) In order to accomplish the above, the Province and the Lake Manitoba Advisory Committee should work in concert, taking full advantage of the knowledge and expertise developed in the existing Lake Manitoba Regulation Review Advisory Committee.

Appendices

Appendix A: Imperial/Metric Conversions

Distance

1 inch (in.)= 2.54 centimetres (cm)	1 cm = 0.39 in.
1 foot (ft) = 0.3048 metre (m)	1 m = 3.2808 ft
1 mile (mi.) = 1.62 kilometre (km)	1 km = 0.621 mi.

Area

1 acre (ac) = 0.405 hectare (ha)	1 ha = 2.471 ac
1 square mile (mi.^{2}) = 2.59 square kilometre km^2	1 km^2 = 0.386 mi.^{2}

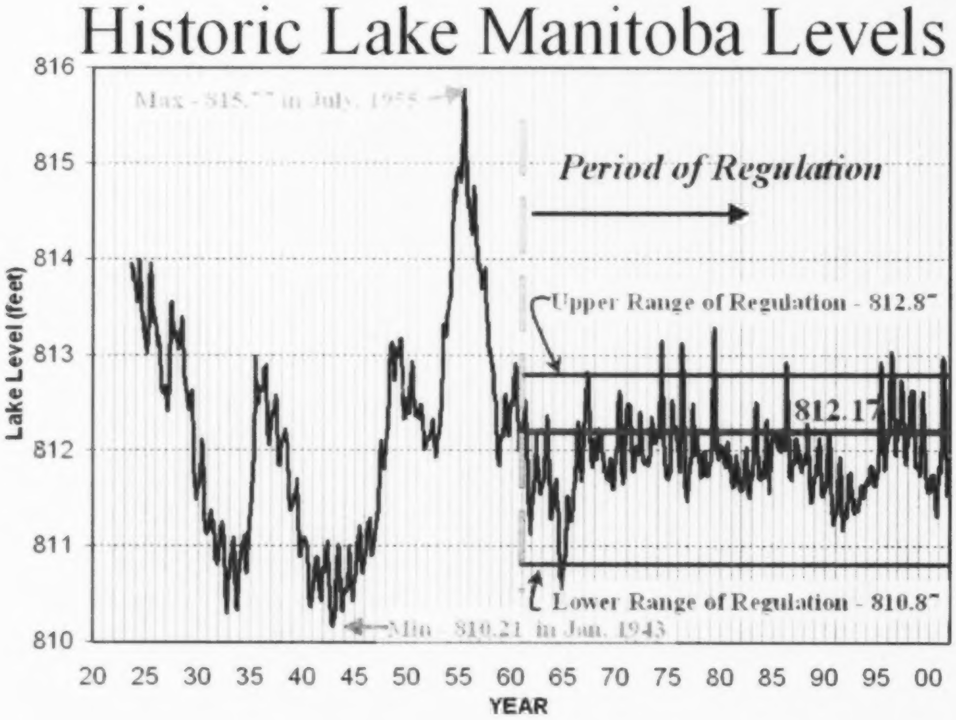
Volume

1 acre-foot (ac-ft) = 1.2335 cubic decametres (dam^3)	1 dam^3 = 0.8107 ac-ft

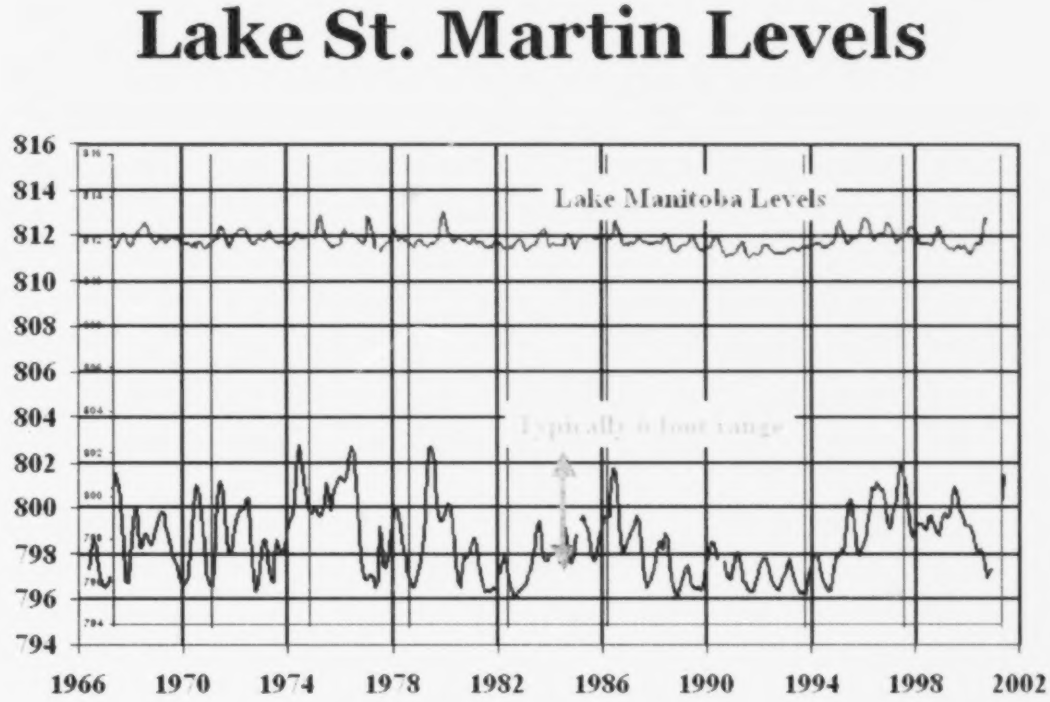
Flow Rate

1 cubic foot per second (cfs) = .0283 cubic metres per second (m^3/s)
1 m^3/s = 35.315 cfs

Appendix B: Historic Lake Manitoba Lake Levels (Monthly Averages)



Appendix C: Historic Lake St. Martin Lake Levels (Monthly Averages)


Lake St. Martin Levels

Appendix D: Minimal Log Change Model

Manitoba Conservation's Water Branch conducted a series of water level modeling simulations on behalf of the Lake Manitoba Regulation Review Advisory Committee. Graphs displaying the results of the Minimal Log Change Model for Lake Manitoba and Lake St. Martin are presented are presented on the following pages.

Under the Minimal Log Change regime, there are no target levels for water levels on Lake Manitoba and Lake St. Martin. Rather, water levels are generally maintained between 810.5 to 812.5 feet above sea level (ft asl) on Lake Manitoba with the expectation that water levels will occasionally reach 810.0 ft asl or lower on the low side, and 813.0 ft asl or higher on the high side. Water levels on Lake St. Martin will generally be managed between 797.0 and 800.0 ft asl. When both lake levels are within the specified ranges, flow through the Fairford River Water Control Structure (FRWCS) would be maintained at 50 per cent of capacity.

If Lake Manitoba is below its range (below 810.5 ft asl) or if Lake St. Martin is above its range (above 800 ft asl), flows through the FRWCS would be set to the specified minimum. If Lake Manitoba is above its range (above 812.5 ft asl) or if Lake St. Martin is below its range (below 797.0 ft asl) flows through the FRWCS would be increased based on the current procedure.

The minimum outflow through the FRWCS is 800 cubic feet per second, except when Lake Manitoba water levels are too low to produce that amount of outflow.

MAPS

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NON FILMÉ

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ProQuest

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